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*Illustrated

The Engineering and Mining Journal

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A New Departure in the Manufacture of Agricultural Phosphates

This is the era of the industrial chemist. Having given us such things as calcium carbide, which has become of great importance in illuminating and metallurgical industries, carborundum, siloxicon, and artificial graphite, which are valuable for many purposes; having developed the art of aluminothermics and others; he is now mastering the problem of extracting nitrogen from the atmosphere and is grappling with that of developing new sources of potash. Now comes an innovation that promises to be of importance in another department of agricultural chemistry, with consequential effect upon the mining and metallurgical industries.

Spencer B. Newberry, who is well known as an expert authority in matters relating to the manufacture of cement, has for some years been making experiments to ascertain what is the effect of calcination at high temperatures upon the crude phosphate rocks of commerce. It is well known that ordinary phosphate rocks as mined are unavailable as plant food, even when finely pulverized. The chief process for rendering this phosphoric acid available has been grinding the rock and treating it with sulphuric acid, which changes the insoluble "bone phosphate" into a soluble form, i. e., soluble in water, and thus easily taken up by the roots of vegetation. Depending upon the composition of the original rock, i. e. the amount of certain basic impurities present, and upon the strength of acid used, etc., some of the phosphoric acid "reverts" into a form which is not soluble in water, but this so-called reverted phosphoric acid is nevertheless available as plant food to a greater or less degree. The agricultural chemists of the world have agreed that treatment with a solution of citrate of ammonia of given strength, applied under given conditions, closely imitates the action of the roots in dissolving reverted phosphoric acid, so that this "citrate-soluble" phosphate is given a valuation by the state fertilizer control stations and is recognized as being nearly, if not quite, as valuable as the water soluble compound for agricultural purposes.

Mr. Newberry discovered that the calcination of ground phosphates alone, if carried out under suitable conditions, rendered the phosphate in most crude rock "available" or citrate soluble, and submission of samples to agricultural stations proved that chemically and agriculturally it is as available as the reverted phosphate which results from the solution in acid. Mr. Newberry and his associates furthermore discovered that the addition of many substances to the ground phosphate rendered the calcination quicker, more thorough and more regular in its product. He found that sulphuric acid, coal dust, common salt, sulphate of lime, sulphate of soda, etc., all produced these results, but that the best effect was produced when the salt of an alkali was employed, preferably that which is one of the cheapest, niter cake or salt cake, which is a byproduct in many places. An increase of the heat, after the effect desired has been produced, drives off by volatilization the alkaline salt, leaving the phosphate not only available to the citrate test, but in a concentrated form.

When the phosphate is decomposed in the old process by 50° acid, sulphate of lime is formed which dilutes the product, so that a phosphate containing, let us say 30% of total phosphoric acid, will yield a product containing only from 15 to 16% of soluble or available phosphoric acid, whereas repeated experiments obtained in many laboratories, have shown that rock running 32% total phosphoric acid yielded, by the Newberry process, a product averaging over 30% of available. There seems to be no question as to this fact, for we have seen reports from a number of State agricultural stations and from other reputable laboratories in many parts

of the country confirming this statement.

Many patents have been applied for: Those covering the use of alkaline phosphates, alkaline carbonates, sulphuric acid, etc, have been granted. The one covering the use of alkaline sulphates has been allowed but not issued, and other patents are being considered at Washington. Patents have likewise been granted in Belgium, Great Britain, France, Germany and other foreign countries.

Should further field experiments on a large scale confirm the availability of this product for fertilization, it should serve as a means of making complete fertilizers containing a large percentage of available phosphate, undiluted with sulphate of lime. It would also mean a considerable diminution in the amount of the sulphuric acid employed at present for making acid phosphates, which acid is now employed to the extent of a million and more tons annually. It seems as if the Newberry product were similar to that obtained from Thomas slag, which to a certain extent is employed in this country, but more largely in Europe, as a source of phosphoric acid.

It is perhaps too early to say anything upon the subject of cost as compared with that of the acid phosphate made with acid, but the product being about twice as rich in available phosphoric acid, there will at least be a saving in transportation and other handling. Further news about this new process will naturally be awaited with interest by the miners of phosphate rock, pyrites and brimstone, and by the metallurgical industries that produce sulphuric acid as a byproduct.

The Mexican Situation

Conditions in Mexico continue to be unsatisfactory. The people of the United States generally know almost nothing of the real state of affairs, an amazing ignorance obtaining except in territory contiguous to Mexico.

President Madero's mild policy and the already proved ease and safety with which brigandism can be undertaken, are responsible for the present so called revolution, and have brought about conditions that cannot be righted in a short time. The establishment of order cannot be expected until the government becomes convinced of the futility of soft words.

So far Americans, and foreigners generally, have enjoyed a measure of safety, but now that the resources of the Mexicans are becoming exhausted, the bandits are looking with lustful eyes upon the possessions of outsiders, who would do well to bear in mind that the bandit is not a patriot, and has no conception, and consequently no fear, of international complications, and has no moral scruples.

Steel Trade Conditions

The movement in the iron and steel trades which took its first start early in the year, when the attempt to control prices was practically abandoned, has proved that it was based on something more than the demand for cheapness. Once started it was found that there was a strong demand for materials of almost all sorts, and that there was a readiness to enter into new construction on a scale which surprised many of the manufacturers themselves. At first buyers did not venture on long contracts and the demand was chiefly for early deliveries. Gradually contracts were extended, though even now they are hardly for as long periods as has been the case in some former years. The buying has been chiefly for immediate or early consumption, and there has been very little speculative purchasing.

Prices have been advanced from time to time, but the changes seem to have been the legitimate result of active demand and based upon the actual conditions of the market. At any rate they have not checked the demand, which has gone on increasing, without much regard to them. As a general rule they are still below the controlled level of a year ago. At the present time we have reports from many important mills and companies which are running to 90 and 95% of capacity. This means practically full, for no mill can keep up to its estimated capacity for any length of time, when allowance is made for casualties, weather conditions and needed repairs. And at this many find some difficulty in keeping up their deliveries of material as it is needed. The present indications are that this state of affairs will continue for some time. The critical period will come with the first of the new year, when many contracts at low prices will expire, and must be renewed at asking prices generally considerably higher. If the present rate of consumption keeps up, the renewals will be made; but some check to new sales may be expected.

The mills are now fairly up to the increases of capacity made or begun during the boom of four and five years ago. With a few exceptions no new enlargements have been made, though some have been begun. Two causes have tended to keep down production in the past two or three months. One is a shortage of labor of which some complaints have been made, though there has been a tendency to keep rather quiet for some reason. The other, which will be felt more during the coming three months, is slow transportation. The railroads are beginning to be short of cars and motive power, and this will be felt more as the necessity for moving the agricultural crops comes upon them. They have been slow in providing increased equipment, as manufacturers know; and while now they are ordering freely, cars and locomotives cannot be improvised in a day.

Taken altogether the steel trade is in a better and sounder position than even during the boom of 1907-8, notwithstanding its complaints of low prices, and there is no serious setback probable, so far as can be foreseen, for a year to come.

The International Congress of Applied Chemistry, which meets in Washington and New York early in September, will bring together a noteworthy group of chemists and chemical engineers. The papers scheduled to be read before the metallurgical section are attractive.

A new development that is likely to be of industrial importance is the competition that is being planned in the American brimstone business. Several deposits on the Gulf coast, supposed to be similar in character to that of the Union Sulphur Co., have been discovered, and at least one of these is likely to be exploited in the near future.

In its Minnesota iron mines, the Steel Corporation has followed the example lately set by the Cleveland Cliffs Iron Co., and has appointed a "mine rescue engineer." His business will be to look after safety appliances at the mines, to determine where they are needed, and to instruct miners in the use of rescue apparatus in case of accident. His chief work will be rather to prevent accidents as far as possible, than to mitigate their consequences.

By the Way

The latest application of the electric furnace in this country is being made by the Bethlehem Steel Co., which is now installing a 10-ton furnace of the Girod type in its works at South Bethlehem. The furnace is to be used in preparing and treating tool steel and other high grades of metal.

The following was found on the bulletin board where machine runners mark up their troubles, at a certain coal mine, says the Ohio Brass *Bulletin*: "No. 4 Masheen awl Shot tu hel. Chain brok. fix the dam thing. it brok twist Last nite. needs new rearstaff leaver for the resisting box. amatoor smokes like heltoo. Power bad. lots of short circles. this is the masheen with self compeller truck. Wer outa oil tu."

Development of the iron resources of Texas on a large scale is to be undertaken by a company recently organized, which has secured property on which to build a blast furnace and steel works near Houston. The raw material will be derived from the ore deposit, a part of which the Bethlehem Steel Co. is developing, and from which shipments are now being made to Pennsylvania. The drawback is the distance of the fuel supply.

An authenticated story is told of a cyanide shiftman who had the habit of overindulgence in the "flowing bowl" to such an extent that his work suffered, and he was notified that the next offence would be his last with that company. In spite of warning, the offence was soon repeated, with immediate result as per specifications. In his maudlin condition, the offender complained bitterly that all the world was against him, and proceeded to imbibe liberally of the contents of the strong solution tank, with the object of ending his troubles. His already overloaded stomach refused to accept this new insult, and sent it back, together with the rest of its contents. In telling of it afterward, the man said that the prompt sobering was the only ill effect of the dose. A like effect, however, could not be guaranteed in every case.

A discovery of gold was announced from Cape Town, a few weeks ago, and the discoverer, a Mr. Tearnan, who is said to have been a prospector in his younger days and to have worked subsequently "in the mines in the north," is reported to have declared that "it ought to set Cape Town aflame." That statement, in itself, when considered in relation to what seems to have been actually discovered, says the South African *Mining Journal*, stamps Mr. Tearnan as a person of a distinctly enthusiastic temperament. The geological details read strangely to a person accustomed to these matters, and when it is asserted that "Mr. Tearnan gages the reef at 30 ft. wide and 1000 ft. long, with a downward tendency at first, running then on the level for a considerable distance," one feels somewhat dissatisfied with the mode of description. Mr. Tearnan preferred not to give the names of the analysts who pronounced his samples to be gold-bearing quartz—which is unsatisfactory from every point of view; so also is the apparent attempt to connect the age of the formation with the value of the reef, as if it had any bearing on the point. The frankly sceptical attitude of the majority of the Cape Town public is commended.

The grubstaker is sometimes repaid, even rewarded, if we are to believe the mid-summer news. Through the heat waves at Knoxville, Tenn., under date of Aug. 22, comes the following dispatch: "Joe Harris, aged 62, who years ago was a prosperous auctioneer, but is now poor, had cause today to remember that 24 years ago on a winter morning he befriended a poor stranger, a man of 28, just from Scotland, whose sweetheart had jilted him. The local postmaster today read to Harris a letter which stated that William Robinson had died in Brisbane, leaving his fortune of $2,000,000 to Joe Harris, who had staked him on a trip to Alaska, where he had "struck it rich." Five years after Harris had staked Robinson, a letter came from Nome, inclosing $500 and stating that Robinson had made a fortune. As this more than repaid Harris for his stake, he was not surprised that he did not again hear from the young Scotchman." We hope this is true. If he went there 24 years ago the lovelorn young Scotchman was certainly in Alaska early enough to have been in "on the ground floor" for some of the good things.

With many years of usefulness still before him, says the New York *Sun*, Sir William Ramsay has resigned his chair of chemistry at the University College, London, as he himself says, "To give a young man a chance." During the quarter century that he has been affiliated with University College, Sir William has made the chemistry department famous and in that time has made a number of discoveries, any one of sufficient importance to insure his own reputation. Several of the distinguished chemist's discoveries have led to the cognizance of new laws of science and have subverted previous ideas upon the subject investigated by him. For example, his verification with Soddy of the theory of the production of helium from radium was a knockout blow to established views on the subject. Another of the scientist's great accomplishments was his discovery with Lord Rayleigh of argon, and with Travers of other gases of the same group, neon, krypton and xenon. The startling characteristic of these gases is their refusal to combine with any other substances, and their discovery filled a vacancy in the chemist's periodic table of elements. He was born in 1852, educated at Glasgow and Tübingen, and was made professor of chemistry at University College in 1887. He was knighted in 1902.

New gold districts seldom get their deserts. It is difficult to keep the "boomers" within reasonable bounds and the bombardment of the over-enthusiastic sometimes causes the pendulum to swing the other way; all reports are discounted and if a sensational mine is not opened, a good, medium- or low-grade camp may not be able to bear up under the burden of enthusiastic expectation and excessive capitalization. Naturally, a new gold district is not a modest violet, but it may be unwisely overboomed in its infancy, as has happened with the Highgrade or Hoag district in northern California. Possibly this district will be proved to have merit as a milling camp, but an extraordinary "boosting" campaign was started from Denver last spring and the district was acclaimed "A Second Cripple Creek." The flamboyant and irresponsible misrepresentation became so great that W. H. Storms, the state mineralogist of California, issued a warning to the promoters that they might be called upon to substantiate certain statements. For this he was promptly excoriated in the local press of the district, as well as assailed in open letters by certain of the leading spirits. The latter became more cautious, however, and when the snows began to disappear some real work was undertaken. The U. S. Geological Survey, with commendable promptness, had arranged to send a representative into the district to make a geologic examination, but this became the signal for another flamboyant outburst of the boomers; the Survey's name was so persistently used in this connection, says a Washington dispatch, that Director George Otis Smith found it necessary last week to issue the following statement: "Notices were being circulated to the effect that the Geological Survey had made a second Cripple Creek gold find in the Hoag mining district, Calif. A geological examination of a number of small mining camps in Nevada and California was ordered recently, but since the Survey is made to appear involved as an involuntary accessory to a newspaper boom the work of the geologist in this mining district has been indefinitely postponed. Under present conditions, for which the Survey is in no wise responsible, work in that region would probably serve only to afford an excuse for further misrepresentations." State Mineralogist Storms has just returned from a visit to Highgrade. His preliminary report indicates that with a continuation of real work a profitable district may be developed, but that in general Highgrade is not high grade, and as a gold-mining boom it nearly died a'borning.

California State Mineralogist's Visit to Highgrade

SAN FRANCISCO CORRESPONDENCE

W. H. Storms, state mineralogist of California, visited the new mining camp, Highgrade, in northeastern part of California during the first half of August. The result of his observations, given on his return to San Francisco, follows.

The Highgrade district is in Modoc County, situated on the California-Oregon state line, on the summit of the Warner range about eight miles by wagon-road east of New Pine Creek, a town situated in both states, and about a mile east of Goose Lake. The state line runs through one of the principal streets of New Pine Creek. The Werner range, as far as the eye can see from this point, consists of tertiary volcanic rocks, rhyolitic and andesitic flows and tuffs. The ore belt of the district is on what may be called the central portion of the range, about four miles in length, in a north-south direction, and about one-half mile wide. The district is as yet undeveloped. The work that has been done is nearly all superficial and has been done since last June, with a few exceptions. The deepest shaft is at the Alturas mine, and is 150 ft. deep. The most extensive development of the older mines is on the Fort Bidwell Consolidated toward the south end of the district. This mine has been in operation for several years, and is equipped with a 10-stamp mill. About 1½ miles to the northward the Big Four mine, which also has been in operation for some time, is equipped with a 5-stamp mill. On the east side of the mineral belt a Lane mill has been installed for the purpose of doing custom work. It is owned by Wall & Co., but has done little milling. So far all the ore milled has been treated by amalgamation, but owing to the extremely fine gold it is probable that the cyanide process can be utilized with good results.

ORES IN ZONES OF BRECCIATION

The ores of the district occur in zones of brecciation varying greatly in width and vertical extent. Some of these zones are intersected by fissures, some of which run in a direction essentially parallel to the main axis of the range, others crossing it. At the intersection of the smaller fissures some rich ore has been disclosed. Most of the ore is too low grade for shipment but it may be milled with profit in the district.

There is an abundance of splendid timber on all the mountains of the region. The water supply in the adjacent cañons is practically inexhaustible. The snowfall is heavy, and the summer season short. There are about 150 men at work in the district. The leasing system, which has been found so effective in the development of new territory in Cripple Creek and elsewhere, has been inaugurated at Highgrade. On Sunshine Hill there are at present 10 leases in active operation, most of which are in good ore.

The geology of the camp is comparitively simple; thus far the pay rock has been found altogether in the highly silicified rhyolite, or a contact of rhyolite and andesite; but nearly always in zones of brecciation. Some of the orebodies seem to be flat shoots; others undoubtedly extend to a considerable depth. Owing to the present conditions from lack of railroad transportation to the mining district, the hardness of the rock, and the present lack of financial aid, it will probably be two or three years before the camp is sufficiently developed to warrant a fair estimate of its real value. However, the present showing will afford sufficient inducement for further development, and the district will undoubtedly produce some good mines.

The town of Highgrade is situated in a little basin on the east side of Sunshine hill. It has one street running in a north and south direction, and is within a half mile of the Oregon line. The trees have been cut, and the stumps still remain. All about the town may be seen the location stakes of mining claims which stand 10 or 15 ft. above the present surface of the ground, showing that the claims were located during a time when there was heavy snow on the ground. In the street of the town there are numerous large cobbles, and boulders of rhyolite. Both sides of the street are occupied by log cabins, square-front shacks, tent houses and tents. There are no saloons in the town owing to the fact that a portion of the district is situated on a school section and license to sell liquor can not be obtained until the applicant has been a resident of the county, at the place where he proposes to sell the liquor, for at least a year. The balance of the district is on the U. S. forest reserve where liquor license can not be obtained. This places Highgrade town and district on the California side in an unique position. In the town the evenings are spent around out-door camp fires, and the men engage in singing and speech-making. The saloons at New Pine Creek are on the Oregon side of the line, also the mercantile houses. The barber shops and the mine offices are on the California side.

The California, Nevada & Oregon R.R. is establishing a new town on the road about a mile from New Pine Creek, on the California side, to be named Fairport. It is said to be the intention of the company to run steamers across Goose Lake for the purpose of shipping to the railroad the lumber from the west side of the lake. The main street of Fairport will run east and west, and extend directly into Pine Creek cañon toward the principal mineral-bearing hills, which are in plain view.

New Copper Country Map

For many years the map of the "Copper Range of Northern Michigan," originally compiled and published by R. M. Edwards, a well known mining engineer of the district, has been accepted as standard. Of late years developments have been rapid and the ownerships have been considerably changed. To meet these changes and to serve adequately those to whom it is of especial value, the map has recently been revised by B. F. Sparks and W. R. Hodge, mining engineers, of Houghton, Mich. In revising, the map has been entirely redrawn and rearranged to include all of Houghton County, all of Keweenaw County except Isle Royale, and the most important parts of Baraga and Ontonagon Counties. All wagon roads, railroads, etc., have been brought up to date and the newer properties shown with distinctive colors. Special attention has been given to the matter of ownerships by smaller, independent companies and individuals, a great number of which are shown in full. Colors have been used freely to bring into prominence the large tracts held by most of the companies. The map is mounted on heavy paper, folded and contained in a canvas-back paper cover, of a size that fits readily into the pocket. It can be obtained for $3 per copy from B. F. Sparks, Houghton, Michigan.

International Association for Testing Materials

Many technical experts, including representatives of various foreign governments, are to attend the congress of the International Association for Testing Materials the sessions of which will open in New York on September 2 and continue through Saturday, September 7. The engineers constituting this association are the men who determine the "factor of safety." At this congress will be considered the standard for a safe rail for present heavy-traffic requirements; fireproof materials and construction; the strength of concrete.

Canadian Bounty Payments

The total amount paid in bounties by the Canadian Government for the year ended Mar. 31, 1912, was only $538,529, compared with $1,591,663 for the preceding year, says the *Canadian Engineer*, Aug. 8, 1912. The bounties paid were as follows: Wire rods, $160,750; crude petroleum, $141,935; lead, $179,288; manila fiber, used in the manufacture of binder twine, $50,556. Since 1896, when the bounty system was introduced, the total payments have been a little over $21,000,000, of which $7,000,000 went for pig iron, over $4,000,000 for puddled iron bars, and $6,000,000 in steel bounties.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Mining on Forest Reserves

I am glad to see that my letter published in the JOURNAL of July 13, 1912, in reference to the practice of the Forest Service has been noticed and answered in the JOURNAL of Aug. 17 by the Forester, H. S. Graves, himself. It is plain that all of us have only the public welfare in view in these discussions.

But, let me quote from the letter, to which mine was an answer and from the official instructions of the Service, "The Use Book." Mr. Booth says "The service has no desire to antagonize the locating of valid mining claims" and "The statutes provide that mining claims may be located only upon a discovery of valuable deposits." And there is the hitch. It is the interpretation of the statute which makes the difficulty. I hold that there is a wide difference between "the discovery of valuable mineral deposits" and "the discovery of deposits of valuable minerals."

The spirit of the statute plainly throws open the public lands for the latter, but the Forestry instructions adopt the meaning of the former. "The Use Book" says, p. 33: "There must be a valid discovery of mineral and a sufficient exploration of the ground to show it beyond question." And again "It must appear that the land contains enough mineral to warrant its disposal under the mining laws." And again on the same page "If the applicant has had ample time and opportunity to show by exploration and development whether valuable mineral deposits exist on the land, and has not done so, his location cannot be held to be a valid mining claim."

I take it that the service is familiar with the veins of the Cripple Creek district. There are many small crevices here, which, upon development, may turn out to be valuable veins or merely planes of cleavage. The prospector may discover one of these and drive a drift on it at a cost of $500. But the crevice shows no pay ore even after that. Nevertheless, the prospector, knowing from the float in the vicinity that valuable deposits exist somewhere, is willing to spend time and money for further exploration, but he wants a patent to secure his title. Under the Forestry instructions patent would be refused. Cripple Creek can show many such examples. Under Forestry instructions the opening of this district would have been impossible.

I know personally of a hill, which has the exact geology of the Cripple Creek district. There is valuable float on the hillside. It is timbered and lies within a forest reservation. It is my intention to prospect that hill and if I find one small vein of good pay value I shall dig further and probably find several other crevices, but which may carry no pay ore. However, I am convinced from the showing that it warrants heavy development. I want to drive a crosscut tunnel to develop all and thus do enough work for patent. I must have good title to form a company with a fair amount of capital and I cannot get this capital until I can prove title. Under the instructions of the service I might get a patent on the one claim which shows pay ore, but the others would be more valuable for timber. I would be refused patent on sufficient ground to warrant the enterprise and possibly a real, new mining district would be lost. And still I am told that the Forest Service does not interfere with legitimate prospecting. I must let this enterprise alone, since I cannot risk the time and money, unless I feel sure that I can get the title to the land, if I find what I think does exist there. This is an actual case. Would the Forester take chances in this enterprise?

MAX BOEHMER,

Denver, Colo., Aug. 20, 1912.

Graphic Solution of Skip Loads

In response to Mr. Case's inquiries, I wish to say that he is correct in assuming that the center of gravity *O*, as found by the method I gave in the JOURNAL of July 13, 1912, is the center of gravity of the plane figure *ABCD*. This, however, is so close to the center of gravity of the skip and load that for all practical purposes it may be taken as such.

In the example given, if the plates *AB*, *CD* and *AC* are made of $\frac{3}{16}$-in. steel, the theoretical center of gravity of the skip and load will lie one-fifth of an inch below *O* and one-ninth of an inch to the left. If the skip is drawn to a scale of one inch to the foot, this distance would not be noticed as the one-ninth of an inch is all that affects the final result, and would be less than $\frac{1}{100}$ in. when drawn to scale.

Mr. Case is in error when he assumes that the wheels would affect the center of gravity of the skip, for the skip rests on the wheels and therefore they would have no effect on the center of gravity, though they would increase the pull on the bail. In practical work, a great many things are done that are not in strict accord with theory, and if the exact center of gravity be calculated in the above problem, it would be a parallel case to reading angles in stadia work to single minutes, and then plotting them to the nearest fifteen.

E. R. RICE.

Miami, Ariz., Aug. 11, 1912.

Copper Determination With Revolving Anodes

An article entitled "Copper Determinations with Revolving Anodes," by Frank H. Probert, appears in the JOURNAL of Aug. 17. The article, which is illustrated with detailed drawings, describes an electrolytic apparatus in use at the Ray Central Copper Co.'s laboratory, without, however, giving credit to the originator of this device for electrolytic analysis with a plurality of rotating anodes. In the same issue the JOURNAL editorially calls attention to Mr. Probert's article and the device described, giving the impression that Mr. Probert is describing something new.

As Mr. Probert is evidently ignorant of the fact that the apparatus which he describes was designed more than five years ago, and that a full description, with detailed drawings and photograph was published 4½ years ago; and as the editors of the JOURNAL apparently have forgotten this fact, we wish to take this occasion to refer them and all those interested to the original articles by us in the January and February, 1908, issues of *Electrochemical and Metallurgical Industry*. A two-column abstract of the original articles appears in the ENGINEERING AND MINING JOURNAL for May 9, 1908, p. 956.

By reference to the first of our original articles, it will be seen at a glance that the electrolytic cabinet described by Mr. Probert is essentially the Fairlie electrolytic cabinet. This cabinet was originally designed in the laboratory of the Tennessee Copper Co., whence the idea was transferred to the Miami Copper Co. and to other Western copper companies, and now to the Ray Central.

There is no objection, of course, to the use of the Fairlie electrolytic cabinet by other laboratories, but it does not seem right—if the apparatus must be repeatedly described—that the designer be altogether ignored in the description, and the credit assumed by others.

We believe that Mr. Probert will be quick to recognize and to acknowledge his error in writing his article without first investigating the prior literature on the subject. Those who will take the trouble to compare Mr. Probert's drawings with our own will be interested to note that after 4½ years it has not been possible for others to improve on the original design.

ANDREW M. FAIRLIE.
ALBERT J. BONE.

Copperhill, Tenn., Aug. 19, 1912.

[Mr. Probert described the installation in the laboratory of the Ray Central Copper Co. and made the most useful presentation of a valuable method that has come to our attention. It is likely that Mr. Probert was ignorant of the origin of this method. For our own part, we frankly confess that we had forgotten it, although we reported it in our own columns about four years ago. We can not find either in Mr. Probert's paper or in our editorial remarks any implication that either of us thought we were telling of something new, the idea being simply that we were telling of something excellent. Nor do we conceive any impropriety in failing always to attach the inventor's name to a description of a method that has become standard. For example, basic copper converting is frequently the subject of description and discussion without any reference to Messrs. Peirce and Smith. As for the present case, Mr. Probert is an honorable engineer and would be the last to assume any credit to which he is not entitled. In his article he did not make any such assumption.—EDITOR.]

Sampling of Ore

"Sampler's" observations in the JOURNAL of Aug. 3, 1912, p. 198, call to mind an experience of mine in checking samples taken by hand. The chief metal in the ore was gold, of which samples varied from $1 to $175. The vein was sampled at intervals of 5 ft., while development work was progressing. During stoping operations on the same block of ore samples were again taken. A grab sample was taken from every car which was drawn from the various chutes, the car samples from the same chutes being combined daily and assayed. The cars were all weighed and the contents in gold computed. Samples were again taken at the feeders to the stamps. Finally, covering a period of about five months, the bullion obtained from the cyanide plant was compared with the computed recovery obtained by subtracting the gold remaining in the tailing from that in the feed to the stamps. The results from the five sets of samples when compared were found to show a range of only 10 per cent.

S. F. SHAW.

Charcas, S. L. P., Mex., Aug. 8, 1912.

Iodide Copper Assay

The articles and correspondence which have recently appeared in the JOURNAL under the above and similar headings are of great interest and should prove of value to many who are engaged in the assay and valuation of copper-bearing material.

The question has been raised as to the best method of separation of the copper prior to the iodimetric determination proper. In the JOURNAL of July 13, 1912, a correspondent claims much for what he pleases to call "the old reliable method of separating copper with aluminum," but I doubt if the average analyst would pin his faith and risk his reputation by the use of aluminum in the way that Mr. Hallett does. So far as I personally am concerned I have not this faith and would not dare to risk my position by the use of aluminum for I cannot with any degree of certainty completely remove copper from an assay solution by means of any metal. Naturally in judging a method of assay, everything depends on the degree of accuracy aimed at; if an error of 0.1% or 0.2% does not matter, no doubt the use of aluminum is perfectly satisfactory, but where more accurate results have to be obtained a more thorough precipitation of the copper is essential. A few years ago I went into this matter somewhat fully and while there is nothing original about the experiments, a summary of the results may be of interest.

For the complete precipitation of copper by aluminum the solution must be free from both nitric and hydrochloric acids. In this connection, it may be pointed out that too much faith should not be placed in the evaporation with sulphuric acid; it was found in these experiments that the last traces of chlorine were difficult to remove, owing to complex secondary reactions with the sulphuric acid, and that the presence of chlorine in a solution (even free from other impurities) prevented the complete precipitation of the copper by aluminum.

The observations of T. Brown, Jr., (ENG. AND MIN. JOURN., June 8, 1905) as to the difficulty experienced in completely separating copper from materials containing arsenic, bismuth, antimony and organic matter were confirmed, and in ores, mattes, etc., containing these impurities in quantity, complete separation of the copper was only effected by the use of sulphuretted hydrogen. Even after boiling two or three hours with aluminum a considerable quantity of copper was precipitated from solution on passing in a stream of sulphuretted hydrogen. To these difficulties, add errors of manipulation, the solubility of the precipitated copper should the sulphuric acid become at all concentrated, the ease with which the precipitated copper oxidizes and passes into solution on washing and you have what Mr. Hallett terms "a reliable method."

True he covers himself to some extent when he states that the method must be correctly handled and all proper precautions taken. He recognizes the possible source of error due to the oxidation of the precipitated copper and in order to minimize it recommends washing with sulphuretted-hydrogen water. In laboratories where the precipitation with aluminum is still adhered to it is, I believe, a common practice to pass in sulphuretted-hydrogen gas after filtering off the copper in order to complete the work of precipitation and so secure the whole of the copper originally in solution. But this double precipitation is needless since the whole of the copper can be directly precipitated by the sulphuretted hydrogen in one operation. This practice is preferred by the English assayers; by its use the risk of incomplete precipitation is completely eliminated.

The precipitated copper sulphide may be ignited and roasted to oxide, or if the dangers of a muffle ignition are feared to the extent Mr. Hallett fears them, they may be avoided entirely by dissolving the precipitated sulphide in nitric acid directly off the filter paper. It may be argued with accuracy that there is a small loss in this operation, owing to the imperfect removal of the precipitate from the filter and to the retention of particles in the fused globules of sulphur, but as shown by Beringer ("Text Book of Assaying") this is trifling and need only be considered when great accuracy is required.

As for the use of sodium thiosulphate as a medium of precipitation; the separation with sulphuretted hydrogen is more rapid and more satisfactory since the conditions as to acidity, etc., need not be so strictly adhered to, and the solution is free from precipitated sulphur.

The iodimetric method of determining copper offers many advantages and is unrivaled where rapidity combined with accuracy is essential. In capable hands its accuracy rivals that of the electrolytic and even surpasses it for the assay of some copper-bearing materials, especially alloys of copper with zinc, nickel and tin.

ARTHUR J. G. SMOUT.

Birmingham, England, Aug. 14, 1912.

Acetylene Lamps

That the prejudice held by a number of engineers against the use of acetylene lamps underground, is a matter of imagination, was clearly demonstrated to me recently when a prominent member of the profession, forced by circumstances to use an acetylene lamp, became its ardent advocate.

F. M. LOTHROP.

Houghton, Mich., Aug. 17, 1912.

Insurance on Mine Property

By W. H. Charlton*

A discussion of the factors which tend to raise or to lower basic insurance rates. Attention to these points when building will save money.

*Mine accountant, 46 Hooker Ave., Detroit, Mich.

The insurance account of a company should receive just as close supervision as any other expense account on the books. By giving it the same attention as other accounts the opportunity for reducing the cost of insurance without reducing the amount carried will be apparent after a careful perusal of this article.

The insurance companies maintain mine schedules for the different camps or districts throughout the country. These schedules can be obtained from the insurance inspectors for the district in which the mine is situated. Below is a mine schedule covering the Lake Superior district, which is applicable to both copper and iron mines.

MINE SCHEDULE

(Lake Superior District, Revised to Jan., 1903.)

Basis Rates

A Brick engine houses, all classes.	$0.75
B Brick boiler houses (separate).	0.75
C Stamp mills (steel frame)....	1.00
D Brick change or dry houses..	1.25
E Shaft and (or) rock houses (steel frame).....	1.25
F Brick carpenter shops.....	1.25
G Brick machine and (or) blacksmith shops.....	1.00
H Brick warehouses.....	0.75
I Frame boarding or sleeping houses	2.00
J Frame coal trestles, sheds and coal	1.75
K Brick office building.....	0.50
L Brick laboratory.....	0.75
M Steam shovels, ore pockets and trestles	1.25
N Steam shovels (all-iron car)...	1.00
O Frame oil house.....	2.00
P Frame barns, stables and out buildings	1.50

Defiency Charges (Cumulative)

To be applied specifically to each building unless otherwise stated.

(1) *Building.*

(*a*) If wood frame filled in with brick or if wood with steel frame, iron clad (not to apply to basis *C, E, I, J, M, N, O* or *P*), add..... $0.25

(*b*) If iron clad on wood (not to apply as above), add..... 0.35

(*c*) If ordinary frame construction (not to apply as above), add 0.50

(*d*) If stamp mills and shaft houses are frame or iron clad, add to basis *C*, or *E*.. 0.25

(2) *Foundation*—If on wood-post foundation t(o apply only to basis *I*), add..... 0|25

(3) *Roof*—If shingle, board or tar paper (to be applied also to frame buildings, but not to basis *C, E* or *P*), add.. 0.25

(4) *Whitewash*—If not whitewashed or painted inside (to apply only to basis *A, B, D* or *F*), add..... 0.10

(5) *Boiler and (or) Engine House*

(*a*) If brick with iron-truss roof and wood roof boards, add.. 0.10

(*b*) If brick with wood-truss roof, add 0.20

(*c*) Metal stack through wood roof, protected by ventilating jacket, add 0.10

(*d*) Metal stack through wood roof without ventilating jacket, at least 12 in. from wood, or breeching through side of building not properly protected by brick or concrete, add 0.25

(*e*) If metal stack through wood roof without ventilating jacket and less than 12 in. from wood, add (instead of item fourth) not less than. 0.50

(*f*) If boiler house is not ventilated, add 0.10

(*g*) If boilers are not covered with brick or asbestos or boiler arch within three feet of wood; or with wood floor in front of boilers, add.... 0.25

(6) *Oily Waste*—If without metal cans for waste in machine shop or where needed, add 0.10

(7) *Change or Dry House*

(*a*) If wood lockers used, add.. 0.25

(*b*) If heated by stoves, add.... 0.50

(*c*) If oiled clothing principally used and kept or dried in building, add..... 0.50 to 1.00

(*d*) If steam pipes are not properly protected, and free from combustible material, add.. 0.25

(8) *Warehouse.*

(*a*) For storage of lubricating oils, add 0.50

(*b*) For wood floors under oil barrels or without drip pans, add 0.25

(9) *Forge*—If on wood base or floor, add 0.25

(10) *Office or Laboratory*—For assaying in the building or for power grinding, add 0.25

(11) *Lighting or Power*—If electric wiring is not in accordance with rules of "National Code," add...0.10 to 0.50

(12) *Bridge Construction* — For covered bridge connecnection (to apply only where tion is between frame building add 0.10

(13) *Fire Protection.*

(*a*) If not protected within 500 ft. by pump of at least 100 gal. capacity per min., according to size of plant, add 0.15

(*b*) If without sufficient amount of 1½- to 2½-in. hose to reach buildings of plant within 500 ft. of pump, add 0.10

Note—Items 13*a* and 13*b* not to be applied to basis *K, L, M* or *N*.

(*c*) If without barrels and buckets of water or chemical fire extinguishers (unless item 13*b* is applied), add..... 0.10

(14) *Exposure.* Charde at discretion.

(15) Objectional Features, add... ....

(16) *DEDUCTIONS*

(*a*) For specific form of policy, with 80% reduced rate, coinsurance or percentage value clause (in states where coinsurance is permitted), 10 per cent..

(*b*) For watchman with approved clock 0.10

(*c*) If shaft or rock house of copper mine has steel frame with steel girders and supports, deduct from basis *E*.. 0.25

(*d*) For protection by fire pump of at least 500 gal. capacity per min., with mains at least 4 in. in diameter and frostproof hydrants within 500 ft. of buildings, 5 per cent.

(17) *Addition to New Rates*—For taxation, muncipal or state —submit).

Rule—Wherever under lease or contract the owner has waived his right of recovery from a railroad company for loss or damage by fire caused by it to the property insured whether from negligence or otherwise, add to the base rates 5%.

Inspectors and stamping officers are

instructed to pass no daily report of policy on such risks as correct where waiver of right of recovery has been made, unless the additional percentage in rate as shown above has been paid.

INOPERATION

..Watchman Clause—It is warranted by the assured that at all times when the property herein described shall be idle or inoperative, a constant day and night watchman shall be kept on duty; and provided that if such property be idle or shut down for more than 30 days at any one time, notice must be given this company, and permission to remain idle for such time must be endorsed hereon, or the policy shall immediately cease and determine.

If at the expiration of 30 days the plant remains inoperative, notice of continued inoperation must be given, and permission therefor endorsed upon the policies. This permit must be based upon the warranty of the assured that during the period of inoperation a constant day and night watchman will be maintained upon the premises, or in lieu of watchman the following form of permit shall be attached:

Permission is hereby given for the premises insured or containing the property insured under this policy to remain inoperative from this date, until the.... ..... day .....19.... And in consideration of this permission, it is hereby agreed that this company shall only be liable for three-fourths of any loss or damage under this policy that may happen to the property insured while the said premises remain inoperative under this permission, and in no event shall this company be liable for more than three-fourths of the sum insured under this policy, for all loss or damage occurring while said premises so remain inoperative under this permission, and this permit is given and accepted under the above conditions.

(No permission for vacancy or inoperation should be given for a longer time than three months in one period.)

POSSIBILITIES OF SAVING MONEY

A working knowledge of the insurance schedule will enable the managers when laying out a plan to design it so as to obtain the minimum insurance rate, as against the costly expense of alterations later to obtain the same results.

As an instance to illustrate this point take a brick or masonry boiler house that would take a base rate of 75c. on the above schedule. To obtain this rate it is necessary to comply with the following conditions:

The building must stand by itself on masonry foundations; the roof must be composition and iron trussed; the roof must be provided with suitable ventilators; the stack must be upon a masonry foundation outside the building and must be connected with the boilers by iron breeching or masonry smoke flue; the inside of the building must be painted or whitewashed; boilers must set on masonry foundations; the boilers must be bricked in or covered with asbestos; they must not be within three feet of any side of the building; iron floors must be provided within three feet of the front of the boilers; electric wiring in the boiler house must be according to the National Code.

Only by complying with the above conditions would the base rate be granted. For each condition not complied with, a deficiency charge is made, as shown in the schedule, and these deficiency charges are cumulative, increasing the base rate amazingly.

From the above illustration it will be seen that the conditions to be complied with in order to obtain the lowest possible rate would not add greatly to the cost of the building provided they are incorporated in the design and specifications of the building when erected.

During the development stages of a mine the type of building that is generally erected to enclose the hoist and a boiler or two with possibly a compressor, is of frame construction covered with corrugated iron, the building setting on posts, and the machinery resting on masonry foundations.

HOW EXTRAS RAISE RATES

Considering the insurance on this type of building, we find that to the base rate of 75c. must be added the following:

For being iron clad on a wood frame, $0.35; for not being whitewashed or painted inside, 0.10; for the building not being ventilated, 0.10; boilers not covered with asbestos or bricked in, 0.25.

With the above extras added the rate will be $1.55. In order to bring this rate down the following changes may be made. By bricking in between the framework of the building up to the eaves, the first extra will be reduced to 25c. The second extra of 10c. can be eliminated by whitewashing or painting the inside of the building. In the third case the 10c. extra can be eliminated by providing suitable ventilators on the roof. The 25c. extra in the fourth case can be eliminated by covering the boilers with asbestos or bricking them in as the case may require.

With the above changes made the rate is reduced to $1.00 and the actual amount of insurance saved depends upon the value of the plant and the amount of insurance carried upon it. The illustrations cited are for specific buildings but the approximate rate for any building under any conditions can be worked out from the schedule applicable to your district. Townsites are generally granted a straight village rate, provided the town is laid out symmetrically and the houses are not within exposure distance; of course there would be extras if the buildings do not set on masonry foundations, also if the town is not provided with the necessary fire protection. All buildings must be provided with chemical fire extinguishers or an extra charge of 10c. will be added to the rate.

A general reduction of 10c. in the premium rate is made on your insurance as a whole, if a night-watchman is maintained, the watchman to be provided with an approved watchman's clock. Another general reduction of 5% in the premium rate on your insurance as a whole is made for adequate fire protection, as explained under item 16-*d* of the schedule.

In states where coinsurance is permitted a reduction in the premium of 10% on the insurance as a whole is made if a "specific form of policy" is written, with 80% reduced rate, coinsurance or percentage-value clause inserted.

The above clause means that insurance must be carried at all times during the life of the policy, in order to obtain the reduced rate, of an amount equal to or greater than 80% of the value of the plant, buildings, etc., insured.

In the event of loss by fire and the insured value was less than 80% of the value of the buildings insured, there would be a corresponding reduction in the amount recoverable from the insurance companies.

This subject of insurance on the mine plant is one that can to advantage be given considerable attention; only two specific illustrations were made to show how this matter can be taken up in a systematic manner, any building or plant on your property may be figured out in a similar manner and the result will probably be beneficial to the mining company.

Burning Powdered Coal

In discussing the abatement of coal smoke with its attendant waste, J. M. Searle (*Proc.* Eng. Soc. West. Penn., July, 1912), took the view that this could often be advantageously done by using powdered fuel. At the American Iron & Steel Co.'s Lebanon, Penn., plant, 300 tons per day of powdered coal are burned, in puddling, billet-heating, welding and miscellaneous small furnaces, besides the boilers. This fuel was introduced in one furnace about nine years ago; now nearly all of the company's 85 furnaces use it. The ash is taken out as a slag. At first there was difficulty with the fuel, because it was not fine enough; it is necessary to powder, not to pulverize. The fuel is shot down against a hearth, in boiler practice, not up against the boiler tubes. The coal is dried just before powdering.

A New Electric Miners' Lamp*

A new electric miners' lamp of improved design has recently been developed by the General Electric Co. to meet the increasing demand for a safe and reliable lamp. The idea of a systematic investigation as to the possibilities of developing such a lamp originated with W. J. Richards, vice-president and general manager of the Philadelphia & Reading Coal & Iron Co.

The lamp is of the combination hand-lantern and headlight type, and consists of a miniature tungsten lamp unit, operated from a light storage battery. The lamp is provided with an efficient reflector, designed to illuminate a 9-ft. circle at a distance of 4 ft. from the lamp, and photometric records show about 2.5 or 3 cp. at a distance of 2 ft. The battery has a capacity of 5 ampere-hours, and is of sufficient size to operate a lamp from 12 to 14 hours.

ELECTRIC MINERS' LAMP USED AS A HEADLIGHT AND AS A HAND LANTERN

When used as a headlight, the lamp, with its reflector, is fastened to the miner's cap and connected by means of a flexible cord to the battery, which is carried on a belt or from shoulder straps, as shown in the accompanying halftone. When used as a hand lantern, the lamp socket is removed from the cap receptacle and inserted into the receptacle on the side of the battery, simply taking the place of the cable attaching plug.

Some of the important points in connection with this design are substantial construction, light weight and compactness; complete inclosure of all conducting parts, use of an absorbent for the electrolyte to prevent spilling, small number of movable contacts, increased efficiency of a 4-volt lamp, efficiency of the reflector, impossibility of charging with reversed polarity, instant convertibility from hat-lamp to hand-lantern.

The battery is flat and compact in order that it may lie as close as possible to the body. It weighs approximately 3 lb. and measures 6½ by 4⅝ by 1⅛ inches. In order to prevent accidental short-circuits, causing sparks, all live parts are totally inclosed in molded compound. The battery terminals, attaching plug, hat receptacle and lamp holder are all molded from hard fireproof and acidproof compound and thus perfectly protected from corrosion due to acid spray or gases.

An absorbent is used for separating the battery plates and also fills up the extra space in the battery, except the mud space. This absorbent acts like a sponge and holds the electrolyte in the battery even though it be inverted for some time.

Where low voltages are used, the pressure drop caused by the contact resistance may be serious. The movable contacts in this lamp have, therefore, been reduced to a minimum and have been so designed that they come together with considerable pressure.

The increased efficiency and life of the apparatus is principally due to the improved tungsten lamp. A 2-volt lamp is somewhat inefficient and has a comparatively short life. This is due to the cooling effect of the large leading-in wires on the short filament. This cooling by conduction reduces the temperature of about one-third to one-half of the filament to a point where little or no light is produced. In order to produce the rated candlepower, the rest of the filament must be operating at a temperature far above a safe value, with a consequent unreliability and shortening of life. The filament of the 4-volt lamp, for which this outfit is designed, is about twice as long as a 2-volt filament, so that the percentage of length cooled by the leading-in wires in a 4-volt lamp is about one-half that in a 2-volt lamp. This allows the rest of the filament to be operated at a safe temperature.

The reflector is made of stamped steel, enameled both inside and outside, thus protecting it from corrosion. Tests have shown that white porcelain enamel forms one of the best possible reflectors, and is durable and easy to keep clean. The lamp globe is protected from injury by a glass plate fastened to the rim of the reflector by a spring. This glass further tends to prevent dust from accumulating on the inside of the reflector.

The contacts on the battery terminal and plug are made concentric, so that no matter how the plug is put in the polarity must be the same each time. A separate plug is supplied for use in charging, and can be wired permanently on the charging rack with its polarity correct. It will then be impossible to charge the battery from this plug with reversed polarity.

*Excerpt from an article by D. B. Rushmore in Bull. A. I. M. E., July, 1912.

Graphite in Korea

Extensive amorphous graphite deposits occur in nearly all parts of Korea, especially in the southern, northeastern and northern districts (*Min. Journ.*, July 27, 1912). The quality, however, is inferior, the carbon contents of the mineral averaging no more than 60%. A fairly soft and good quality with more than 80%, and fit for export, has so far been found in a few mines only. Working costs are low, so far as mining itself is concerned, but, as all the properties are situated far from shipping places and good roads are scarce, transport is difficult and expensive. The better sorts of the Korean mineral are blended in Europe and America with Ceylon graphite, and used for making crucibles, while the lower qualities are turned into paint stuffs, lubricants, blacklead, etc. The total production amounted in 1906 to 1000 tons, in 1907 to 5000 tons, in 1908, 18,000 tons, in 1909, 18,000 tons, in 1910, 12,000 tons, in 1911, 10,000 tons. For export the graphite is packed in barrels of 320 lb. each, present prices for best amorphous being £5 5s. c.i.f. London, £4 15s. c.i.f. Amsterdam, and $25 c.i.f. New York. The low level of prices is due to overproduction since 1909 and to the fact that large consignments shipped by speculators to Europe

and America, having remained for years without finding buyers, had at last to be sacrificed for next to nothing.

A Romance of Industry*

The hundredth anniversary of the founding of the great firm of Friedrich Krupp has been celebrated in Germany much as if it were a branch of the government, as in a sense it is. The Kaiser himself took part in the celebration, together with the Prussian Minister of Commerce, and many decorations were distributed among the leading employees. The firm divided $3,500,000 among its army of workmen. The newspapers devoted column upon column to the history of this great enterprise, the rise of which is so bound up with that of the German Empire itself. Indeed, the century that has passed since the first Friedrich Krupp started in business marks the modern development of this greatest of the Continental nations. A hundred years ago Germany was just beginning to throw off the Napoleonic yoke; she had begun to feel the first stirrings of that national life which was to flower at Versailles in 1871, and to that flowering the Krupps of that period contributed enormously by the munitions of war which they had produced for the wars of 1866 and 1870. Germany has proportionately grown not more, if as much, than the company which is today, as for decades past, the greatest maker of war materials the world over.

The founder of the firm, the first Friedrich Krupp, began the iron and steel business with a handful of men, imitating English methods and practices. Of a family already well-to-do for that period, he would none the less have failed but for the aid and counsel of his grandmother—women have played a distinguished part in the story of this vast concern. The founder himself died in 1826, before achieving any material success. Indeed, the firm was insolvent when his widow, Therese Krupp, with her 14-year-old son Alfred, undertook to carry it on. But Therese Krupp's determination was speedily reinforced by the discovery of her son's remarkable scientific and business talents. Shouldering while still a boy the tremendous cares and responsibilities which were his sole heritage, he had by 1837 an establishment of 55 workmen, with receipts of approximately $25,000 in that year. Gradually he forced his way into the field of high-grade machinery, and in 1847, a year before he bought out the other members of his family, he sent to the military authorities a three-pounder, breech-loading cannon, which was the beginning of his connection with the military affairs of Germany.

Today every German military or naval cannon is a product of the Essen works, and the Krupp devices and system have been adopted by Austria-Hungary, Italy and Russia as the basis of their artillery. Up to 1902 alone the Krupps had sold 40,000 cannon to no less than 30 states—enough to make them great believers in the necessity of armed peace! But guns were not their only product. Steel rails and all sorts of railroad and machinery materials have been turned out in great quantities, and every invention in the steel or iron industries has been promptly adopted, and often improved upon. Nowhere else has the union of applied science and industry been more marked or more serviceable. In the perfectly equipped Krupp chemical and physical laboratories 500,000 analyses are made annually in direct connection with orders and routine business, quite aside from any experimenting. With the tremendous expansion of his work, Alfred Krupp gradually began to buy coal and iron mines, notably in the north of Spain. And as the German navy and mercantile fleet developed, the company, not content with furnishing the armor and guns, established the great German shipbuilding yards at Kiel to compete for vessels of war directly, and also bought a ship-repair works at Rotterdam. Its foundries and iron works and mines are scattered all over South Germany, all operated on a capital of $40,000,000. In 1903-04, the first year of operation as a stock company, the net profits were nearly $3,000,000, after paying taxes of $800,000 and contributing $1,300,000 to the insurance fund of the more than 71,000 employees, or to benevolent and philanthropic undertakings on behalf of the workmen.

Such was the achievement of Alfred Krupp's genius. He died in 1887, and was succeeded by his son Friedrich Alfred, to whom the present Kaiser, his intimate friend, has erected a monument. For Friedrich Alfred Krupp died in Essen in 1902 and left his vast fortune to his daughter Bertha, whose husband, von Bohlen-Halbach, is the real director of the enterprise, or rather the head of the cabinet which now guides the works. But the influence of the real owner is visible in the steady extension of the philanthropic undertakings of the firm; their men are well housed in 4342 model dwellings, and for their families there are schools and kindergartens, and institutions of every kind for the sick, the invalided, and the orphaned. Yet even in Essen strikes have been known, and the Socialist vote is tremendous, despite the Kaiser's having once solemnly proclaimed there in Essen to the workmen that to vote for a Socialist was to commit treason to the state—whereupon the Socialists promptly carried the district. Yet it is in many ways a model community, while the business itself has the same record of producing quality above quantity, of seeking always new means of using steel and iron, and of never standing still, which explains this wonderful romance of industry, favored as it has been by kings and emperors. Certainly it is no exaggeration to say that all Germany prides itself on the Krupp establishment.

*From the Evening Post, Aug. 16, 1912.

Opening of the Gillies Limit

SPECIAL CORRESPONDENCE

The excitement caused by the staking of the Gillies Timber Limit has died away, and all that many of the prospectors can be said to have gained is the memory of an interesting moment. To the lawyers belong the spoils, as there is bound to be much litigation. The crowd of stakers and their assistants, who were waiting on the Limit with their lanterns till midnight of Aug. 19, were orderly, and, although many of the men carried guns, no trouble was experienced. Promptly at midnight the race to stake the claims began and it is probable that bush claims were never before staked in so short a time.

One man claimed the record for having completed the legal staking in 28 min. The claims once staked, the rush to the recorder's office began. Special trains, automobiles, bicycles, fast power-launches and horses were used, the first men reaching the office in Haileybury, shortly after 1 a.m. The crowd lined up in an orderly manner, but shortly after the recorder's office was opened at 8:30 a.m., the men began to push their way in; the line was broken and the office crowded. In several instances people were endeavoring to record the same claim. The recorder was unable to differentiate so that all these disputes will be referred to the mining commissioner. This will doubtless lead to much litigation.

There has been much speculation as to the cause of the rush, because the Limit has never produced any good mines and the outlook is not encouraging for future development. The reason, however, is not far to seek. During the present season there has been little staking going on throughout northern Ontario and the majority of the prospectors are "broke." When it was announced that part of the Limit would be opened, an opportunity for making a little money was presented. It was not difficult to find men who were willing to risk a few dollars, particularly in view of the fact that many of them were approached with the tale that the prospector could stake a lot having a good vein known only to himself. The consequence was that many of the prospectors received employment for a short time. Others staked with the idea of turning their lots over quickly to promoters or leasers.

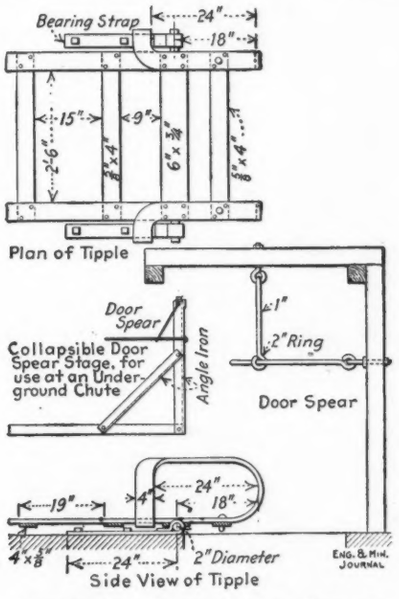
Time alone will tell the value of the Limit, but as far as can be learned, not a single lot has a discovery showing silver in commercial quantities.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

Spear Type of Car Dump

In the accompanying drawings are shown the details of the construction of the spear type of car dump that is used in many coal mines, but which is not so frequently seen at metal mines. In fact the only metal mines that are using it are those of the Desloge Consolidated Lead Co. in the southeastern Missouri lead district. This type of dump has its advantage, especially when low, long cars are used. While such shapes of cars cannot be used to advantage in mines where the drifts must be heavily timbered and the tracks are crooked, still there are many metal mines



TYPE OF CAR DUMP USED AT DESLOGE MINES

in this country where such cars could be used. The advantages of using low, long cars of large capacity are not appreciated. The lower the car, the greater is the tonnage that can be loaded per man; and the larger the capacity of the car, the cheaper is the tramming cost, other things being equal.

Any car that is to be dumped with a spear type of tipple must be fitted with a squirrel-cage type door, and this door must have a loop extending above it for catching on the spear, so that it will be raised in respect to the body of the car as the tipple dumps the load. This loop, owing to the side movement of the long body according to the way that the car is seized with respect to the rails, should be at least 10 in. wide, and 8 in. high.

In the spear type of tipple the car body is dropped enough by the cradle so that the bottom of the car assumes an angle greater than the angle of repose of the material. The front of the car body then strikes a cross piece or else the floor, so that it cannot dump or go down farther. In rigging up a dump at a chute where the roof is so high that the spear cannot be suspended from it, two uprights are carried up from the stringers, carrying the cradle bearings. These uprights are fastened by a single bolt in each side, so that they can turn on them as pivots. Angle braces, also fastened by single bolt at each end, come up and secure the uprights from pushing forward when the door strikes the spear. When blasting near-by, the bolts of the strap braces can be taken out and the whole frame lowered down on the ground where it will not be damaged by flying rocks from a blast. An accompanying drawing shows this arrangement.

The front support of the spear must be arranged so that it will slide back on the spear and hook it up as the car comes forward into the dump. The spear must catch into the loop on the door a little ahead of the dumping of the car, so that, if for any reason, there is a failure of the spear to catch the loop, the car will not dump with the door unlifted, possibly causing trouble through overbalancing of the car.

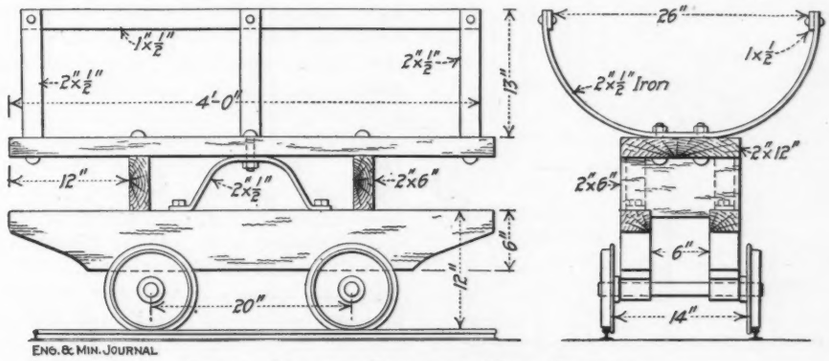
Moving a Keystone Drill in the Tropics

The work of prospecting placer ground in a tropical jungle with a Keystone drill, of the nontraction type, is about equally divided between road making and drilling. In the dry season a road 12 to 15 ft. wide is cut through the bush two or three weeks before the drill is to pass over it, the sun is thus given a chance to dry up the ground and provide a little better surface. During the wet season it is necessary to lay plank tracks ahead of the machine and at the same time have jacks and blocking at hand to pry up the wheels which frequently slip off the tracks into the mud.

Districts are frequently encountered where no draft animals capable of pulling the drill are available. In this case it is necessary to resort to man power and a plank track is always provided. A man, at each wheel, with a crowbar will usually be sufficient motive power for ordinary ground. One man steers, another blocks the wheels and two are kept busy moving the track. When the road is particularly bad, a block and tackle hitched ahead to a tree, usually solves the difficulty.

Car for Tramming Drill Steel

In the Joplin district the ore is trammed almost entirely in buckets. These buckets rest upon low, flat-topped cars that are not convenient for transporting drills, dynamite, machines and other supplies about the mine. In the accompanying drawing is shown a convenient car for such purposes.



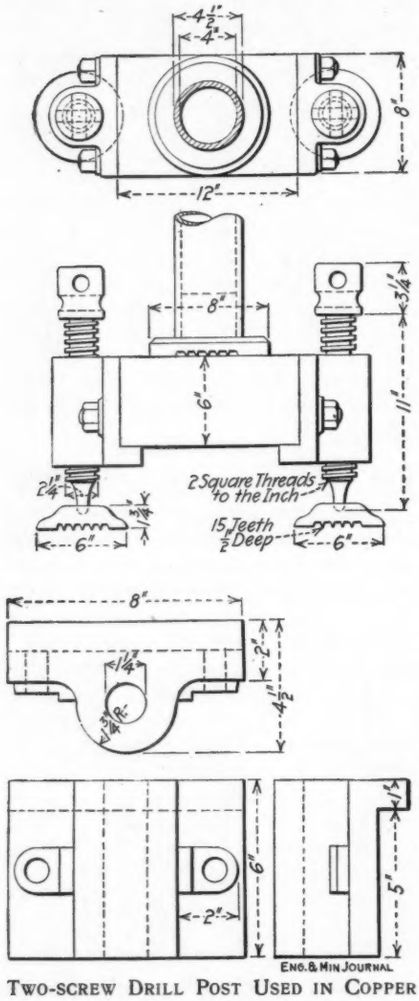
JOPLIN CAR FOR TRAMMING MINE SUPPLIES

The body of the car is raised high enough from the track to be convenient. The rack on the top is circular and made of 2x½-in. strap iron. It is strapped together longitudinally only at the top so that in tramming dynamite to the underground magazine the boxes can be piled flat on the deck of the body, which is about 12 in. wide. The other details of the car are evident from the drawing.

The miner's inch is defined by California law as equivalent to 1½ cu.ft. of water per minute through any aperture or orifice.

Copper Range Drill Jack and Post

An unusual form of drill post is used in the mines of the Copper Range company in Michigan. This post has two toothed ends. It is mounted on top of a two-screw jack which is fitted with a wooden center block into which the teeth of the bottom of the post nip when the post is set up. The post and the jack are independent and thus the weight is divided. Moreover, one jack can be made



TWO-SCREW DRILL POST USED IN COPPER RANGE MINES

to serve several lengths of posts. This is a decided advantage whenever, as at the Copper Range mines, it is necessary to have several lengths of posts owing to the different heights of the back from the filling. The advantage of a two-screw jack is obtained without the drawback of the great increase in the weight of the posts that is so objectionable where the two-screw jack is fastened tightly to the post part.

The jack nuts are castings that have a projecting ledge for the wooden block to rest upon. Two bolts go through the block and hold the nut castings and jack blocks together. This jack block lasts about a year before it becomes so worn that it has to be replaced. The post, while it looks somewhat crude at first glance, will be found to have decided advantages under certain conditions, especially where posts of different lengths are necessary. The post part is simply a standard 4-in. gas pipe with toothed head pieces shrunk tightly into it at both ends. Because of the cheapness of the post, the men in the stopes are given three lengths. Consequently, they do not have to build up much blocking when making a set-up.

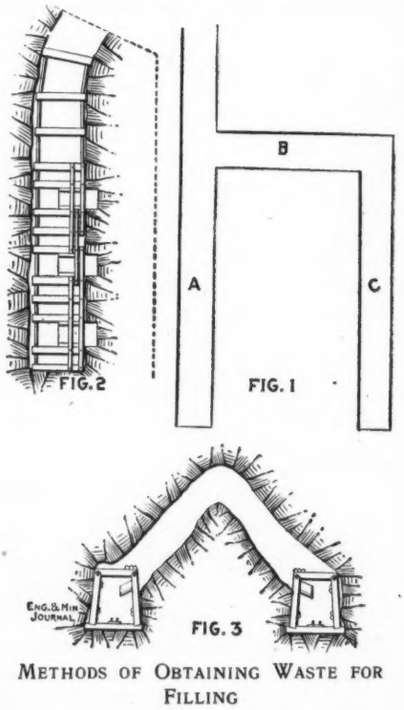
Stope Filing and Caving for Waste

Depleted stopes are filled with waste for support in several ways, and the waste is obtained from many sources, states Ernest K. Hall, in the *Mining and Engineering Review*. Occasionally in the case of small orebodies, sufficient waste is obtained from development, and from wall rock unavoidably broken in the stopes. The mine that can obtain sufficient waste for stope filling from these two sources of supply is fortunate. In many places, water-borne sand residues from mills can be used.

Opencutting for waste on the surface can often be carried on cheaply, but in older mines it sometimes happens that filling cannot be economically conveyed to them from the surface. Of course, this remark also applies to the use of dry-sand residues. In such a predicament, resort is at times made to driving or raising from the stopes for the necessary filling; but these waste drifts and raises are entirely unsatisfactory, the drift being the more objectionable on account of the extra handling from the face. The overwhelming disadvantages are: The cost of breaking waste is as excessive as that of breaking ground in development work, yet the advantages of well judged development are absent; their use induces a tendency to work these orebodies with insufficient connection for good ventilation, attended by labor inefficiency.

A means of gaining waste by caving is especially adapted to erratic ore deposits, provided the country is favorable to its adoption. When the rock weathers away quickly, and in small fragments but large quantity, it is well worth considering whether or not waste caving can be advantageously employed. If there does not already exist, remote from known or probable ore, an old unused drift or crosscut, one is driven into suitable country. As soon as a point has been reached at which caving is unlikely to cause damage to the stopes, and levels above, laying out the cave is commenced.

It may be taken as a general rule that the maximum caving effect will be obtained when the cave drifts run parallel with the strike of the lode, or with a fault system, rock bedding, or whatever may be the weakest zone. On this account should it be necessary, in seeking a suitable position, to run a crosscut at right angles to the strike to such lines of weakness, on reaching the intended cave area it will generally be advisable to turn the cave drift parallel to this direction of weakness. At the Tasmania mine, Beaconsfield, where waste caving was practiced with success, a crosscut *B*, shown in Fig. 1 of the accompanying illustration, was driven for 50 ft. from a drift *A*, and from the extremity of *B*, a drift *C*, was driven parallel to *A*, *A* and *C* being driven at the Tasmania, a distance of 50 ft.; the lengths of *A*, *B* and *C*, in the illustration are shown different from the Tasmania instance. The ground was stoped out above each drift as though the work were done on two narrow veins meeting like the slopes of a gable roof, the ground being taken out just wide enough for economical stoping, say 40 in., and the backs supported,



METHODS OF OBTAINING WASTE FOR FILLING

where necessary, by stulls and head boards and lagged. Such were put in at 4-ft intervals, and a chute put in every alternate set. When all was ready a pop charge was put in each stope stull and these were fired.

An alternate method of laying out the cave drift is to cause such a drift as *A*, in the accompanying illustration to fork into two parallel branches 20 to 50 ft. apart. Fig. 2 shows one leg of the fork; Fig. 3 is a cross section applying to both methods. Fig. 2 shows a case requiring stronger timbering, chutes are put in at six-feet intervals; 6-in. poles are spiked a *C*, across the caps from set to set on the chute side, also from leg to leg.

In all waste caving, the cutting out of the ground when started, should be pushed on with the greatest speed possible until completed, so as to obviate premature settlement and consequent excessive use of timber, for this would mean trouble before caving commenced, with consequent blocking of the chutes. In suitable ground there is seldom difficulty in drawing almost all the timber before caving sets in. The run may start from a day or two to a week or even more, after the stulls are shot out, and so long as waste is constantly drawn from the chute, it will continue to run.

There are probably many instances where an old drift on a lode or fault wall could be made to serve the purpose, by beating out a stope six or seven feet high, for any convenient distance, putting in the necessary chutes. Dead work would then be reduced to a minimum, and timber would not be required in carrying such a stope.

At the Progress mine, New Zealand, not long ago it was possible to gain a quantity of useful waste by periodically cleaning up an old prospecting drift which crosscut a system of parallel faults. Although no chutes were put in and waste had to be shoveled from the floor, that was nevertheless a welcome addition to waste gained from development work. Under the somewhat exceptional conditions favoring it, the caving method will be found a useful and cheap means of obtaining waste in large quantities.

An inclined shaft at the Salisbury mine in the Michigan iron country starts from the surface dipping in one direction but changes its dip to the opposite direction at depth, necessitating a skip with wheels on top and bottom.

Magazine for Storing and Thawing Dynamite

By Claude T. Rice

In the accompanying drawing are shown the details of construction of the magazine used by the St. Louis Smelting & Refining Co. But, before passing to the description of the magazine itself, it probably will be well to call attention to the fact in choosing a site for the magazine, a hollow was selected so that there is practically no possibility of any one shooting into the magazine except if done with malicious intent. The magazine is several hundred yards away from any other building.

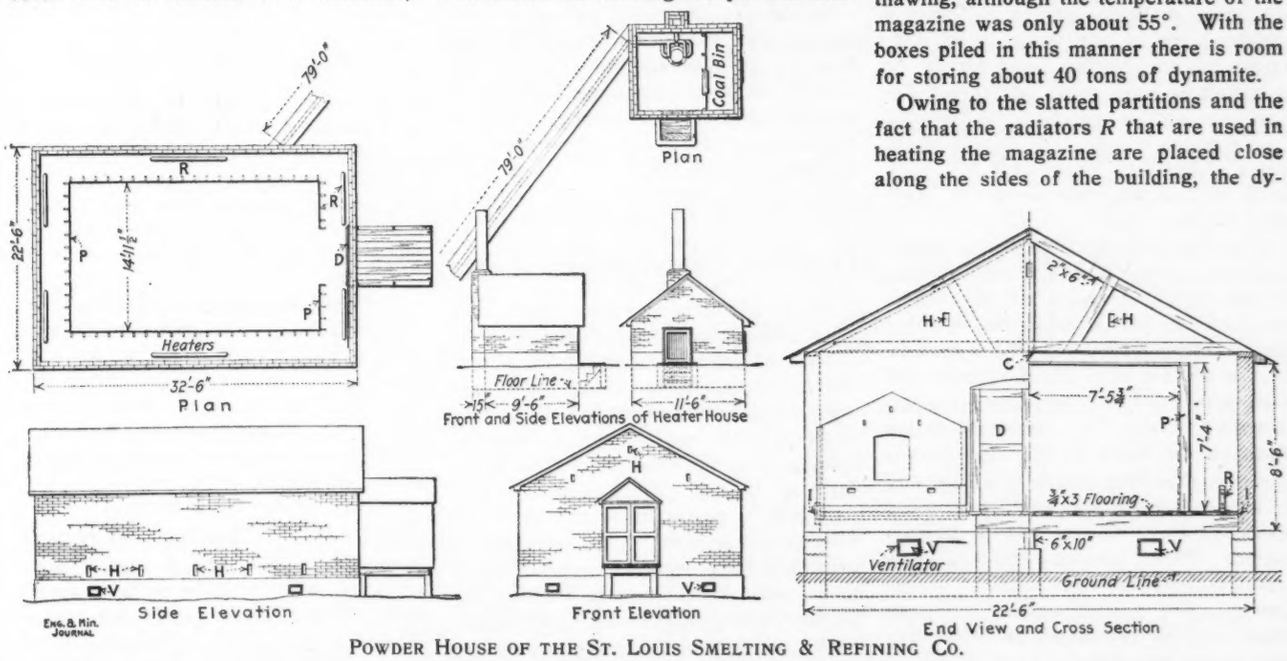
The important feature of the magazine is that the dynamite is thawed in the boxes without any unnecessary handling. This makes the thawing cheaper and less dangerous, for at every point where the dynamite is handled there is a source of danger, while it might also be well to add that owing to the headache that results the job of unpacking and repacking dynamite is not a desirable one. It is a mistake at large mines to erect magazines for thawing dynamite in which it is necessary to take the dynamite out of the boxes; such handling of the dynamite only pays when the amount that is used each day is small. The thawing house should be large enough to hold at least a week's supply as then the thawing can be done slowly. Consequently, it is just as well to do the thawing in the magazine itself as to do it in a separate place.

The small thawing houses ordinarily shown in the catalogues issued by the dynamite companies are built so as to require unpacking the dynamite and are absurd affairs only warranted at small mines where the erection of a suitable magazine heated by steam from a separate building is not warranted.

It will be noticed from a study of the accompanying drawings that there is a partition *P* of 2-in. planks carried on studding of 2x6-in. lumber built out three feet from the walls inside which the dynamite, still in the original boxes, is piled. To enable air to circulate between them, the boxes are piled with ½x2-in. strips between them. A small space is also left between the vertical rows of the piles. As the air is free to circulate around the boxes, it only requires about three days to thaw frozen dynamite in the box when the temperature of the thawing room is kept at 70° F., while last winter in the coldest weather with the thermometer outside 15° below zero, it only took about five days to do the thawing, although the temperature of the magazine was only about 55°. With the boxes piled in this manner there is room for storing about 40 tons of dynamite.

Owing to the slatted partitions and the fact that the radiators *R* that are used in heating the magazine are placed close along the sides of the building, the dynamite can be placed within three feet of the water pipe. The hot water for these radiators is generated in a Tabasco No. 21 heater which is directly connected to the water pipes without any temperature regulating mechanism being installed on the heater, for force the heater as hard as one can, it is impossible to heat the magazine above a temperature of 70° in ordinary winter weather. It might be well to add that in this connection it probably is better to install a heater of the right size than to depend upon some regulating mechanism to keep down the temperature in the magazine. In a colder climate than that of southeastern Missouri during an ordinary winter, although last year the thermometer went down to 16°, the next larger heater should be used.

The heater house is placed 79 ft. away from the magazine. The hot water used for heating the magazine shown in the



Powder House of the St. Louis Smelting & Refining Co.

drawings is carried to the magazine building in pipes incased in asbestos pipe covering. Anthracite coal is used to fire the heater.

Both the heater building and the magazine are placed on concrete foundations. The walls of both buildings are made of brick. Corrugated iron is used for the roofing laid on top of 1-in. planking. A ceiling *C* of 1x3-in. lumber is carried across the building even with the tops of the side walls so that ample air space is left above the dynamite to allow the magazine to be kept cool in summer. This air space is connected with air holes *H* but in winter these are kept closed. The floor is made of 1x3-in. planks, and there are air holes *V* connecting with the space under the floor as well as others *I*, coming in just at the level of the floor. These air spaces are arranged so that it would be difficult for a malicious person to insert a burning piece of oily waste in the magazine in case, during labor trouble or at any other time, some one should decide upon such a procedure for revenge. Owing to the ceiling, it is impossible to pile the dynamite higher than the brick walls that protect the dynamite from stray bullets.

To prevent the chilling of the magazine during the loading each morning of the dynamite supply for the different shafts as well as when frozen dynamite is being loaded into the magazine, double doors are provided. These are lined with sheet iron to prevent the entrance of bullets. The outside doors are those on the front of the covered entrance and loading platform which acts as an air-lock, as one might say, when taking dynamite into or out of the magazine. This covered entrance also serves to keep the cold winds in winter from blowing directly against the main doors, chilling the magazine more than they would otherwise.

The magazine is placed at a distance from the shafts. According to the Missouri law the dynamite supply in the mine may not be more than enough to last 24 hr. Consequently, the dynamite has to be taken from the magazine to the different shafts each day. This is done by placing the boxes of thawed dynamite in a transfer box, built with double walls, of 2-in. planks so as to provide an air space two inches wide all around the box. This box has low wheels attached to it and travels along a track of 1x6-in. iron nailed to the floor of the magazine and extending out on the covered porch or entry which is arranged so that it just comes even with the bed of an ordinary wagon such as is used in hauling the dynamite to the different shafts.

This transfer box is made so as to hold about 30 boxes of dynamite, which is ample supply for one day at these mines. It is loaded with the dynamite in the magazine, and then pushed directly to the wagon, the doors of the magazine only having to be opened long enough to push the box through. Owing to the air space in the walls the dynamite does not freeze in the box even with the thermometer down to 16° below zero in the open. At the different shafts the number of boxes of dynamite that are required are taken out of the transfer box and the cover replaced instantly. This thawed dynamite is placed directly on the cage and lowered to the underground magazines before it has a chance to freeze. The transfer box when empty is returned to the magazine and placed inside it again so that it will be warm when the dynamite is loaded into it next day. This magazine was built according to the directions of George A. Allen, of the Aetna Powder Co.

Around the magazine and at a suitable distance is a picket fence 6 ft. high. Between the fence and the magazine also outside the fence for a distance of 10 ft. is a deep layer of tailings so as to prevent any danger from brush fires reaching the magazine.

Locating Underground Pipes

In waterworks systems there are often pipes, the exact position of which is not recorded, and when repairs or new connections are to be made with such pipes, a great deal of time and money may be saved by the use of a device which will indicate their positions, says *Eng. News* for Aug. 15, 1912. Some electric devices have proved successful in this field, one of them being based on the principle of causing a slight flow of electric current in the pipe, which thus becomes a conductor. When an electric coil is brought within the field of this conductor, a current will be induced in the coil and cause a sound in a telephone receiver connected to the coil. The sound increases or decreases as the coil is carried nearer to, or farther from the underground conductor, but ceases when nearest to it; that is, directly over it. By locating a number of points directly over the pipe, its situation is accurately determined.

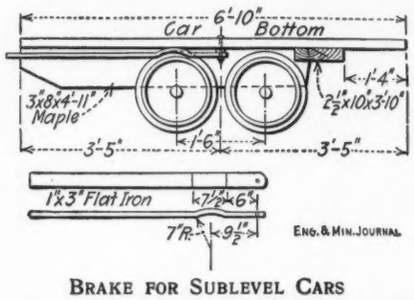
In using the instrument, wires from a portable battery, are attached to suitable connections and the operator, carrying the instrument in his hand and the receiver at his ear, walks across the supposed line of the pipe, the exact position being indicated by the absence of sound. To locate a service pipe the battery wires would be connected to the house cock and hydrant, creating a current along the service line. This device is manufactured by the Modern Iron Works, of Quincy, Ill., and is used by a number of water companies.

Brake for Sublevel Car

By L. D. Davenport*

The accompanying sketch shows the details of a car brake used on some of the sublevel cars in one of the mines in the Chisholm district in Minnesota.

The brake consists of a piece of 1x3-in. flat iron about 4 ft. long, curved near one end to fit the tread of a 14-in. carwheel. It is fastened to the bottom of the car with a ½x6-in. bolt, so that it has plenty of play. When not in use, the end



Brake for Sublevel Cars

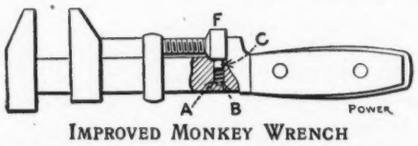
of the brake extending beyond the car is held up by a hook, so that the curved part is clear of the wheel.

Where the grade is unusually steep, two of these brakes are used, one on each side of the car, and one of the miners stands on them and rides down to the chute.

The main advantages of this brake are that it is cheap, the cost amounting to little more than the value of the iron, practically indestructable and simple, having only three parts, the main bar, the bolt and the hook. Any blacksmith can make one and any miner can, if necessary, put it on the car.

Improved Monkey Wrench

An old monkey wrench usually works so easily that it tends to shift its adjustment. I have, states Jacob Lustenberger in *Power*, overcome this trouble by removing the handle and screw and drilling



Improved Monkey Wrench

a 3/16-in. hole as shown at *A* in the illustration. Into the hole is inserted a spring *B*, the tension of which should not be too great. On the end of the spring the plug *C* is placed so that it binds against the knurled roller *F*.

This kink works most satisfactorily when using the wrench in cramped quarters. It may be further improved by drilling a number of depressions the size of the face of the plug into the roller. The spring would then force the plug into the depressions and hold it more firmly.

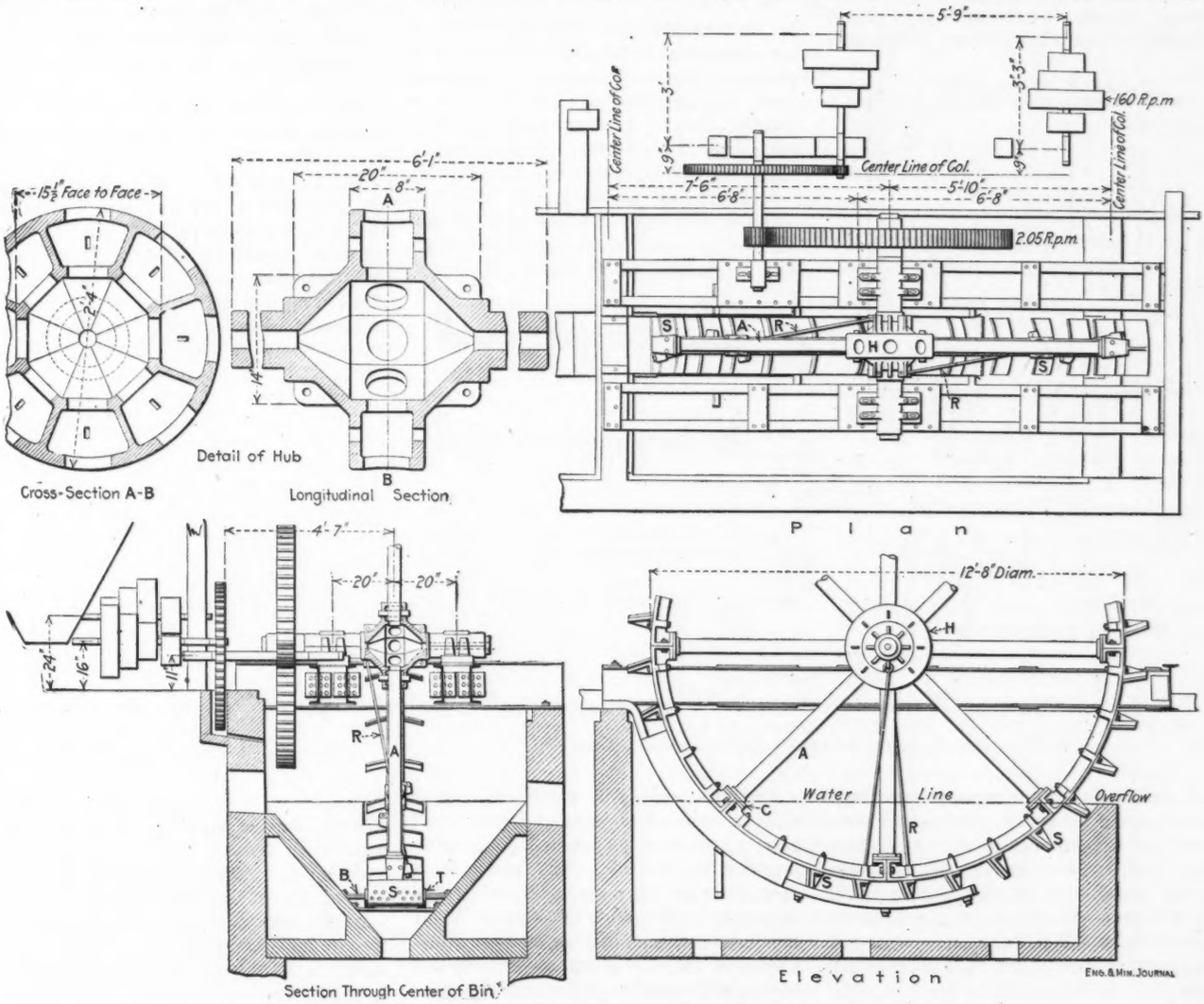
*Assistant chief engineer, Oliver Iron Mining Co., Chisholm Division, Chisholm, Minn.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Tailings Dewatering Wheel

In the accompanying drawings are shown the details of construction of the dewatering wheels 14 ft. in diameter that are used in the No. 3 mill of the Doe Run Lead Co. at Rivermine, Mo. for dewatering the tailings before discharging them on the belt conveyor that takes them to the tailings pile. There are two of these wheels; each handles 1500 tons of pulp in 24 hr. when run at 2 r.p.m., the most efficient speed.



SMALL TAILING DEWATERING WHEEL USED IN FLAT RIVER DISTRICT, MISSOURI

Referring to the general drawing of the shovel or dewatering wheel, it will be seen that this wheel is made of segments tied together by bolts and arms to a cast-iron hub. This hollow hub-casting extends beyond the sides of the tank that the wheel runs in and forms the axle to which the driving gear is keyed. The hub has sockets in it to receive the pieces of 4-in. pipe that are used for the spokes or arms of the wheel. There are eight of these spokes or arms, and they screw at their outer end into a cap piece that bolts to flanges on segments of the rim. There are eight of these segments in the rim, and they are bound to the hub by ⅝-in. tension rods *R* that go through lugs on the rim segments and hook into the hub. These tension rods are hooked into the hub before the rim is assembled.

As will be noticed the tension rods alternately pass through the wheel from different sides, and each rod hooks into the hub on the other side from the lug on the rim into which that rod fastens. The arms at the inner end are fastened to the hub by keys. After the wheel has been assembled and trued, zinc is poured around the pipes where they fit into the sockets of the hub. To these outer segments, sheets of ¼-in. iron 18 in. wide are fastened to form a deflector for catching the rock particles that adhere to the shovel blades.

The shovel blades or scrapers are then bolted through the rim of the heavy reinforcing segments of the wheel. These scrapers slant back slightly from the direction in which the wheel rotates, so as to make the angle of the discharge about

45°. They are cast with ⅝-in. holes so as to allow the water to drain back out of the tailings as they are scraped up the trough. This, to protect it from wear, is fitted with cast-iron wear plates. The scraper blades are 18 in. wide and are made concave so as to cause the tailings to run towards the center of the shovel, as the shovels rise out of the water narrowing the stream that is poured out into the spout that leads to the conveyor belt.

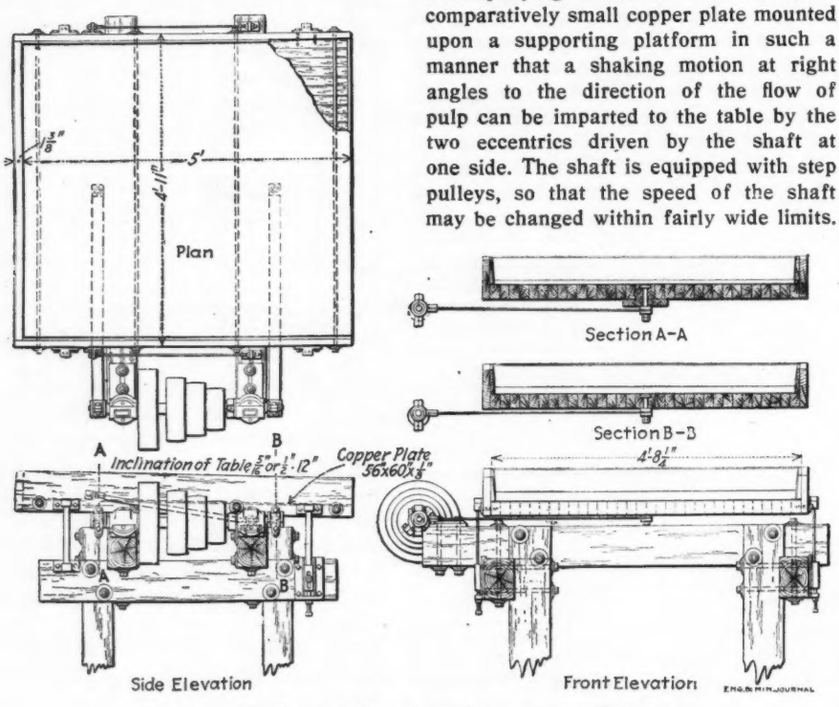
The tailing wheel rotates in a concrete tank with sloping sides so that any tailings that settle on the sides will slide down to the bottom of the tank and be scraped up to the discharge by the shovel blades. In the tank is a trough carried on iron bars that are anchored in the concrete. The purpose of the trough is to confine the coarse tailings that settle into the shovel box so that the blades can scrape them up to the discharge spout easily and without spilling. The trough does not extend much beyond the point where the tailings are poured into the settling tank by the feed launder that comes in from the side of the box. The feed launder comes in about the level or the discharge spout while the overflow lip is about 8 in. below the bottom of the discharge spout.

In the first wheel built, the false bottom or trough was carried directly under the scraper blade so that there was not much clearance left for the blades. Some of the blades became broken in one way or another and these fragments upon getting wedged between other blades and the false bottom broke more blades. Consequently in the later wheels, the trough is being placed lower so as to allow more clearance around the shovel blades. But it is probable that it would be still better to let the tailings build up their own bottom in these shovel tanks.

These tailing wheels are driven by gears, and the driving pulleys of the train are arranged so that the speed of the wheels can be varied so as to run at 4, 2 or 1 r.p.m. This was in order to determine the best speed at which to run the wheel so as to get the lowest amount of moisture in the tailings being handled.

Shaking Amalgamation Table

The amalgamation table shown in the accompanying illustration consists of a comparatively small copper plate mounted upon a supporting platform in such a manner that a shaking motion at right angles to the direction of the flow of pulp can be imparted to the table by the two eccentrics driven by the shaft at one side. The shaft is equipped with step pulleys, so that the speed of the shaft may be changed within fairly wide limits.



A Standard Type of Shaking Amalgamation Table

The platform upon which the copper plate is mounted is made of a number of battens, smoothly planed and held tightly together by tie-rods. The platform is carried above the base by four flexible standards. The table is shown in the illustration as manufactured by the Allis-Chalmers Co., for a mill in Ontario and for several mills in Colorado, Montana and other western mining districts.

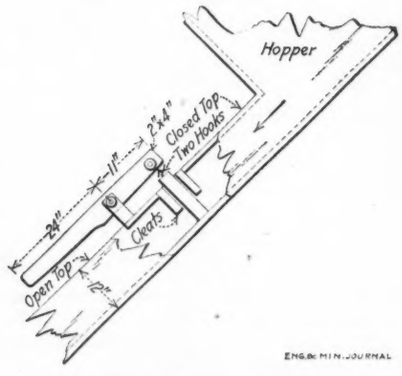
The advantages of using shaking amalgamation tables has been questioned; one of the objections raised being that the mercury is jarred off the copper plate. That this objection is well founded seems to be indicated by the experience with such tables in a certain mill in the West. A narrow copper cleat was attached to the lower end of the main copper plate, and behind this cleat little balls of amalgam would roll up and find lodgment.

The table is set at a very low grade, so low that banking of the coarser particles of pulp would occur if the table were stationary. The vibration prevents actual settling and where trouble is experienced by small particles of clay settling on stationary plates in spite of heavy inclination, and which settling causes the formation of a coating on the surface that interferes with amalgamation, the shaking table may be used sometimes to advantage.

Gate for Roll Feed Trough

A gate for controlling the feed of ore to rolls or crushers, or even elevators, is shown in the accompanying illustration. In many mills the feed to intermediate crushers or rolls comes from some screening device such as a trommel, under which there is a hopper of moderate storage capacity, and from the bottom of which a launder or trough leads down to the rolls.

It is usual to make this trough of considerable length, and in order to obviate blocking or choking as much as possible, it is advisable to make the trough as wide as convenient. In many mills the upper part of the trough is covered over, so that it becomes a box chute, but just above the rolls there should be no covering, in order that the millman may at all times be able to see whether or not the feed to the rolls is coming down properly no matter in what part of the mill he may be.



Gate for Controlling Roll Feed

At the bottom of the closed section of the trough a simple gate of the type shown in the accompanying drawing should be used. The handle of this gate extends down far enough so that it may be closed quickly by an attendant standing near the rolls. By this means of control the time lost in digging out the rolls may be minimized.

It is also advisable to place an electric light with a good reflector in back of it in such a position that a strong light will be thrown upon this spout which will better enable the attendant to see how the feed is coming to the rolls when he is at a considerable distance from the machine.

The Cost of Doing Things

Data from Mining and Metallurgical Practice

Round Mountain Mining Co.

The Round Mountain Mining Co., Round Mountain, Nev., according to its annual report for 1911, milled 54,915 tons of ore having a gross value of $7.09 per ton, of which 85c. was lost in tailings and $6.24 recovered in the mill. The total mining and milling cost of $4.45 is made up of stoping, $2; development, 90c.; milling, $1.16; bullion tax, transportation, marketing and insurance, 7c., and general expenses 32c. per ton. To this must be added depreciation on mine plant and equipment, 31c., and litigation over title to mining claims, 20c. per ton. A credit of 8c. for miscellaneous earnings makes the net operating expenses $4.88 and profits $1.36 per ton of ore milled, which is equivalent to 21.8% of the net yield of the ore in gold.

The development work consisted of 3273.5 ft. of drifts, 1688 ft. of crosscuts, 2450 ft. of raises and 97 ft. of winzes, a total of 7508.5 ft. In the statement of costs it is stated that this work cost $49,520, which is equal to an average cost of about $6.60 per ft. The ratio of development to production was about one foot for every 7.35 tons of ore milled. Approximately 54% of the tonnage nage mined is rejected as waste; by installing an underground crushing plant it is expected that this average will be raised to 66% of the ore mined. The principal items included in general expense were: Mine office, 6c. per ton; Goldfield office, 8.2c.; automobile, 2.9c.; liability insurance, 2.04c. and general mine expense, 10.7c. per ton.

Labor in an Arizona Crushing Plant

The Arizona Copper Co., Clifton, Ariz. in its annual report for the year ended Sept. 30, 1911, says in regard to a new crushing plant which it installed during the year: "As now arranged, the ores are delivered through the new shaft, situated 426 ft. uphill from the original concentrator building, into the coarse-ore bins of 1000 tons capacity; from these bins the ore is automatically fed on to a conveyor belt, and the coarse smelting ore is picked out by hand. This belt then delivers it on to a grizzly, with bars spaced two inches apart, the oversize dropping into a gyratory crusher, which reduces it to 2-in. size.

"The ore is next passed through revolving trommels, with manganese-steel jackets, perforated with ¾-in. round holes; the oversize is delivered to a wide, slow-traveling conveyor belt, on which a further sorting of smelting ore can be done. It then passes under powerful magnets by which any odd pieces of steel are removed, and the ore drops through heavy crushing rolls, set to crush to ½ in. The product of the rolls, together with the fines separated by the trommels, now drops on a third conveyor belt, which delivers it into the fine-ore storage bins, of 2000 tons capacity, the ore being distributed into the bins by means of an automatic traveling tripper. This dry-crushing plant has a capacity of about 1700 tons in 10 hr., and is operated by three men."

Wettlaufer-Lorrain Costs

The Wettlaufer-Lorrain Silver Mines, Ltd., South Lorrain, Ont., treated 4166 tons of ore in the mill during quarter ended June 30, 1912. Based upon the tons milled, the cost per ton, including all expenses, was $11.80, made up of $8 for expenses at the mine and mill, and $3.80 for general charges, such as freight, smelting, superintendence, etc. The expenses at the mine and mill were: Development, $1.42 per ton milled; stoping, $1.30; timbering, 28c.; tramming, 21c.; hoisting, $1; ore sorting and concentration, $1.32; mine office and general, 18c.; assaying and surveying at mine, 38c.; moving ore from dump, 20c.; boarding house expense, 40c.; plant and equipment, 88c.; and general mine expense, 43c. per ton milled. Of the tons milled, 2279 tons, or 54.7%, came from dumps, making only 1887 tons from the mine. Of the general charges, smelting was $1.45 per ton milled, or $52.40 per ton of product; freight to smelter, insurance, assaying, etc., 56c. per ton milled, or $20.18 per ton of product; superintendence and engineers' salaries, 65c. per ton milled; taxes, 60c., and New York office expenses, 54c. per ton. Based upon the tons of product shipped, the total cost was $426.52 per ton.

The total cost per ounce of silver was 24.684c., leaving a profit of 36.101c., figuring silver at 60.785c. per oz. The company expended $3481.97 on options during the quarter, which is equal to about 1.75c. per oz., not included in the cost stated. The cost at the mine was equivalent to 16.735c. per oz. of silver, smelting charges, 3.033c.; freight to smelter, insurance, etc., 1.168c.; and other expenses, 3.748c. per oz. The development work amounted to 621.5 ft., of which 385 ft. were raises and winzes, 216.5 ft. drifts and 20 ft. crosscuts. This was equivalent to one foot of development for every 3.4 tons of ore taken from the mine, the average cost was about $9.50 per foot.

Tigre Mining Co. Costs

The Tigre Mining Co., El Tigre, Sonora, Mexico, according to its annual report, produced 46,945 tons of ore during 1911; of this tonnage, 45,079 tons were milled and 1866 tons shipped. The total cost of operating was $15.51 per ton, from which a credit for sundry profits of $1.14 was deducted, making a net operating charge of $14.37 per ton. The various items included in the total cost were: Mining, $3.047 per ton; development, 94.3c.; transportation to mill, 13.9c.; milling, $4.33; general expenses, including management, etc., 88.2c.; marketing and taxes on ore and concentrates, $5.182, marketing and taxes on bullion, 30.2c., and treatment of dump tailings, including taxes and marketing charges, 68.5c. per ton of ore produced.

Of the total mining and development expense, $2.883 was for labor, 35.2c. for explosives, 14.9c. for light, 48.8c. for general supplies and 11.8c. for general power. The cyanide dump tailings treated amounted to 5922 tons and based upon the tonnage treated the cost was $4.855 for treatment and 59.8c. for marketing and taxes on bullion. It is stated that 4098 ft. of development work actually placed in sight 31,300 tons of ore; which would be equivalent to about 1 ft. of development for every 7.66 tons of ore. The total cost of development was $10.80 per foot advanced, or 23.6% of the total mining expense.

In the stamp mill it cost 97.6c. per ton, made up of 45.8c. for crushing, 6.2c. for regrinding and 45.6c. for concentrating 13,974 tons of ore, while at the old mill the cost was $2.632 per ton, of which 42.4 was for crushing, 49c. for regrinding, $1.534 for concentration and 18.4c. for construction. The cost of treatment in the cyanide plant was $4.287 per ton treated and consisted of 13.1c. for conveying and screening tailings, 93.4c. for tube milling; 24.3c. for classification, elevating and dewatering; $1.804 for cyanide treatment, 38.2c. for filtration, 18.1c. for precipitation, 25.2c. for melting and 36c. for alterations.

The average grade of ore milled during 1911 was 0.182 oz. gold, 28.56 oz.

silver, 0.091% copper and 0.388% lead per ton, while the average grade of all the ore handled was 0.2776 oz. gold, 39.61 oz. silver, 0.196% copper and 0.858% lead and the average value $27.75 per ton.

Producing Sulphuric Acid at Port Wallaroo, Australia

The following data were extracted from the 1911 annual report of the Wallaroo & Moonta Mining & Smelting Co., South Australia. The smelting works are situated at Port Wallaroo, seven and ten miles from the Wallaroo and the Moonta mines, respectively. Since the company has installed a converter plant it has been of no advantage, in blast-furnace treatment, to have the ores treated in the pyrites burners. The entire charge of operating the burners has, therefore, been charged against the production of sulphuric acid. During 1911 the plant operated 44 weeks and produced 4627 tons of acid, or an average of 105 tons per week. Extensive repairs were made which interrupted operations for nearly eight weeks, the cost of this work is included in the figures given herewith, which represent the approximate cost of producing one long ton of sulphuric acid at this plant during 1911: Wages $3.19; machinery, plant and material $1.69; fuel 33.3c. general charges 3c.; stationery, printing, etc., 0.5c., fire insurance 6.1c., water 4c., and establishment 20.1c. making a total of $5.55 per ton. The average price received from the sale of sulphuric acid, which is bought by the Wallaroo Phosphate Co., was about $7.39 per ton, indicating that the profits averaged $1.84 per ton of acid.

Iron Ore Mining in Crystal Falls District, Michigan

The Crystal Falls district is situated in Iron County, Mich., on the Chicago & Northwestern R.R. Dr. C. K. Leith says of the district: "The ores are in the upper Huronian slates, except for the Mansfield, which is in a band of slates in the Hemlock volcanics, and the Groveland, which lies at the base of the upper Huronian series in the Felch schist." The iron formation lenses are described as being about the same as in the Iron River district. The active mines show total shipments of about 14,000,000 tons of ore to date, 17 of the principal properties appraised by J. R. Finlay for the state were estimated to have 8,054,000 tons of probable ore in reserve.

The Tobin mine, operated by Corrigan, McKinney & Co., is the most important, and the Bristol, of the Bristol Mining Co., ranks second. Other mines in the district are: The Crystal Falls, Lincoln, Fairbanks, Lamont, Armenia, Great Western, Genessee, Genessee No. 2, Kimball & Dunn, all owned by Corrigan, McKinney & Co.; the McDonald, of the McDonald Mining Co.; Mansfield and Michigan, of the Oliver Iron Mining Co.; Hemlock, of the Hemlock Mining Co.; Gibson, of the Rogers Brown Ore Co.; and Channing, of the Verona Mining Co. Besides these mines there are seven or eight important explorations that have shown considerable ore by drilling. The average depth of the mines is about 1000 ft. The profits of the district for five years were shown by Mr. Finlay's report to have been $6,238,753 for 10 mines operating at a profit, while six mines lost $710,684 during the same period.

A summary of the five-year period, 1906-1910, shows that the average cost per ton of the ore produced was 80% of the total value of the ore at Cleveland. This cost was made up in the following proportion: Mining, 31% of the average value of the ore; exploration and development, 1.1%; construction, shafts, machinery, etc., 6.6%; general expenses, administration, etc., 2.6%; royalties, 7.6%; taxes, 0.5%; rail freights, 11.5%; lake freights, 16.5%; and commissions, 2.6% of the average value of the ore. According to this the profit on the ore mined in the district should be about 20% of its average value.

West Rand Consolidated

The West Rand Consolidated, Transvaal, South Africa, during 1911 mined 359,249 tons of ore from which 39,559 tons, or 11.01%, were discarded as waste by sorting. The mill treated 319,640 tons in the 302 days run, with an average of 100 stamps crushing 10.58 tons each per day. The cyanide department treated 316,124 tons, of which 186,271 tons were sand and 129,853 slime. The total working cost was $4.82 per ton milled, made up as follows: Mining, $2.50; sorting, crushing and transporting, 16c.; milling, 41c.; cyaniding, 39c.; general charges, 38c.; head office expense, 35c., and development redemption, 63c. per ton. The average value of the yield was $5.56 per ton, which leaves a profit of about 74c. per ton milled. Approximately 64% of the gold was recovered by milling and 36% by cyanidation. The theoretical extraction by cyanide was 84.83% and the actual extraction, 88.20%. An average of 2820.5 men was employed, of whom 345.5 were Europeans and 2475 natives; this would indicate that about 115 tons of sorted ore were mined and treated per year per man employed.

The annual report of the Ooregum Gold Mining Co. in India shows that the consumption of cyanide is 0.62 lb. per ton; caustic soda, 0.611 lb. and zinc, 0.094 lb. per ton. The yield in gold per ton cyanided is approximately 0.0955 ounce.

Shaft Sinking, Goldfield Merger Mines

A record of vertical-shaft sinking at the Goldfield Merger Mines Co., adjoining the Goldfield Consolidated, Goldfield, Nev., according to data furnished by L. H. Metzgar, general manager, was as follows:

After enlarging the shaft to 7x16 ft. for a depth of 470 ft. sinking was started by hand drilling and continued to a depth of about 700 ft. by this method. The rock was of medium hardness and work was carried on in three shifts of eight hours each with five men on a shift. About 60% of the drilling was done with churn drills and the rest by single-hand drillers. Approximately nine hours per day were required for drilling and blasting and the average advance was 3.81 ft. per day.

The dynamite consumption was 8 lb. per foot of shaft, or 0.0714 lb. per cu.ft. of rock broken. Timbering required about seven hours for each 5-ft. shaft set which indicates that an average of 5.33 hr. per shift was required for timbering. On this basis the time was divided as follows: 37.6% for drilling and blasting, 40.4% for mucking, etc., and 22% for timbering. With a total of 120 man-hours per day this would mean that one foot of shaft was sunk or 112 cu.ft. of rock removed for every 31.5 man-hours of which approximately 11.8 were for drilling and blasting, 12.7 for mucking, etc., and 7 for timbering.

After sinking by hand, as stated, four 2¾-in. Ingersoll-Rand C110 drills were used to sink from about 700 to 1200 ft. depth. The ground during this period was variable from soft to medium hardness. Three shifts of eight hours each, six men per shift or 144 man-hours, were worked per day. The average advance was 4.2 ft. of shaft, or 470.4 cu.ft. of material per day. The dynamite consumption was 11.68 lb. per ft., or about 0.096 lb. per cu.ft. of rock. It required about seven hours per day to set up machines, drill holes, take down machines and blast. The average advance per machine drill was 1.05 ft. of shaft or 117.6 cu.ft. of ground. According to figures given the average day's work was composed of 29.2% for drilling and blasting, 45.5% for mucking, etc., and 25.3% for timbering. A total of 144 man-hours per day would mean that 1 ft. of shaft or the removing of 112 cu.yd. of rock required 34.3 man-hours, of which about 10 were required for drilling and blasting, 15.6 for mucking, etc., and 8.7 for timbering.

While the sinking by machine drills shows an increase of 2.8 man-hours per foot over drilling by hand it must be remembered that the time of raising and lowering men and material was much greater.

A System of Mine Sampling

By E. F. Pelton*

Close mine sampling is necessary at the Detroit Copper Co. since distinct walls distinguishing ore and waste are lacking. In blocking out an orebody, channels to give a 9-lb. sample per foot are cut with moil and hammer in 5-ft. blocks, two or three samples being taken in a block. Generally the channeling is horizontal. In stope sampling a rough groove is made with a geologic pick so as to give a 3-lb. sample per foot, larger samples being taken in spotty ground. The mine sampling gives results 5 to 10% too high.

*Chief geologist, Detroit Copper Co., Morenci, Ariz.

Note—A paper presented at the Morenci meeting of the Phelps-Dodge Geological Conference, March, 1912.

The introduction in 1908 of the caving methods of mining by the Detroit Copper Co., emphasized the need of a system of mine sampling to replace the haphazard and unrecorded grab sampling of an overworked shift boss. While the methods adopted are subject to minor change, the too frequent neglect of this important branch of mining, and a dearth of information in technical literature on the every-day sampling at mines, may warrant a somewhat detailed description.

No Distinct Walls

Sampling methods must take into account the rather divergent types of ore occurrence. Oxidized ores of copper in limestone and shale which first brought the district into prominence are still encountered, though in small amount. The common form is the replacement type of fissure vein, in which chalcocite and cupriferous pyrite are the valuable minerals occurring in rather persistent fissures and as a network of small veins in a dry kaolinized porphyry. Closely associated with this are stockworks in porphyry and in friable quartzite. Distinct walls are lacking, ore grading into waste at the boundaries of the stopes, and it is this factor which compels close sampling.

For 1911, ore of 1.75% Cu was regarded as the minimum workable grade, the average tenor for that period being 2.87% Cu. A production of 1600 tons per day is mined in one eight-hour shift; 90% of this from top slicing and sublevel caving, and 10% from block caving and square setting.

Five men, under the supervision of a chief sampler, are usually employed; three to four "stope" samplers, who make daily rounds of the stopes and development work; and one or two "channel" samplers, who systematically sample given blocks of ore. The aim of stope sampling is to draw a dividing line between ore and waste. The aim of channel sampling is to accurately determine the copper tenor of certain blocks of ground, whether portions of such blocks are rich ore, lean ore, or waste. Hence the methods of work are different.

Channel Method in Ore Blocks

In the stoping methods in vogue it is essential to know the size, shape and character of any block of ore before the details or even the method of mining can be planned. A large orebody may frequently include irregular masses of low-grade material. Is it better to mine only the higher-grade portions at an increased tonnage cost or the entire body at a lower extraction figure?

Is there ore enough to warrant an extra crosscut or where should a certain raise be placed? Data furnished by thorough sampling must be at hand to supply such information.

This sampling is done by channeling or grooving and follows closely the blocking out of an orebody. The chief sampler examines the ore, giving instructions as to the manner of taking each sample. Measurements are made from survey stations, and, as a rule, the ore is divided into 5-ft. sampling blocks.

Loose rock and small projecting pieces are first dressed off. Canvas is spread on the floor, and from the smooth face a channel with squared sides and bottom following the irregularities of the wall is cut by moil and hammer. The channels are from 4 to 5 in. wide and 1½ to 2 in. deep, representing 9 lb. per foot. Preparing the face and squaring the channel are to insure taking an equal amount from every part of the cut.

The channeling is usually done by experienced men; but when the amount of work increases, it may be necessary to employ other labor under the supervision of a sampler. In such case, greater care is taken with the preliminary smoothing of the face, and both width and depth of cut are increased to yield 15 lb. or more per foot, as an offset to the lack of experience and interest.

Rich and Lean Ore Separately Sampled

In ore showing much variation in grade, two or even three samples may be taken to represent a 5-ft. block, with the object of keeping the richer and the leaner ore separate, and calculating the block from measured sample widths. Where the rich veins are closely associated with ore of low grade, it is customary to gouge out the veins first, including the adjacent enrichment, rather than to take the second class first, which might lead to salting. In extreme cases, such rich samples may be but $\frac{1}{10}$ ft. wide. Beyond this point the accuracy of a sample is more than offset by error in measurement.

Another reason for this separate sampling of rich ore is that it tends to eliminate errors in the preparation of samples for assay; the rich samples being brass tagged and separately treated in the crushing room. On completing one side, the opposite wall is cut in the same manner as a check on the original work.

The above applies chiefly to crosscuts, though the same details are observed in the back sampling of drifts, except that the sample interval is generally increased to 10 ft. or more.

While most of the channeling is horizontal at breast height, no rule is followed other than to make the channel represent its particular block. In "bunchy" ore, such as may be found at the intersection of veins or oxidized ore in limestone, it may be necessary to cut channels both above and below the middle height of the crosscut or to incline the channeling at any angle from 0° to 90°. Interesting but fortunately uncommon cases have arisen where mineralized horizontal quartzite beds have been intersected by two vertical series of veins, each at right angles to one another—a sort of isometric mineralization. Separate sampling was done on each of these systems, the results being combined in certain proportions.

It is only ore or ground that at some future time may be regarded as ore, which warrants channel sampling. In exploratory work of a lower tenor than 1%, development sampling or more rapid cutting is sufficient. Channeling with pneumatic-riveting machines has given satisfactory results in soft ore, but in harder material pieces breaking along seams outside of the cut caused so much trouble that the experiment was abandoned.

Ore from each of the larger stopes is separately put through an automatic sampler at the mill, thus affording a check on the mine work. For a period of 12 months, in which 26,000 tons were produced, the estimated grade of ore by mine sampling for one stope was 2.20%, while automatic sampling showed a grade of 2.10%. This percentage of error is supposed to represent a constant, though it might be safer to assume that mine sampling is from 5% to 10% too high.

Of the two most important local errors entering into mine sampling, one is the occurrence of the richer ore in softer rock, there being that tendency in sampling as in other matters to follow the line

of least resistance, and so cut a somewhat larger proportion of the softer, better mineralized material; and again that the chalcocite which is closely associated with the brittle pyrite is more apt to break back from the cut than is any individual piece of gangue and thus form an undue amount of mineral. Related to these, though not a sampling error, is the general impossibility of mining the ore clean, and this factor may at times become the most important.

The accompanying form of sample ticket, 3x6 in., printed on tough, rather heavy colored paper is used, the color distinguishing the special samples from the similar white form of the stope ticket. The sample ticket is protected by placing the folded ticket into the neck of the sample sack, which is then gathered into pleats and firmly tied.

Stope Sampling to Distinguish Ore from Waste

The equipment for sampling the stopes and development work is a heavy geological pick, tape, small compass, note book, etc., and small acetylene lamp worn on the hat. A convenient device to catch the sample is a flatly conical bag supported on a square wire frame, which also serves as a handle.

The sampler covers an assigned route every day, and in stopes of doubtful grade, two or even three visits may be necessary. Since the prime object of stope sampling is to distinguish ore from waste, little attention is paid to the richer ore beyond an inspection of fresh faces. Time is spent to best advantage near the edges of the stope where ore grades off into waste.

Having selected a place where the pay grade of the ore is open to doubt, the sampler picks down any loose projecting rocks along the line of the proposed sample, and then makes a rough groove perpendicular to the trend of mineralization. Where the distribution of the mineral is fairly uniform, from two to three pounds per foot is taken, but where its character is spotty, and it frequently is such in limestone and shale, the amount is increased to five or six pounds per foot. As the chutes are at squared intervals of 30 ft., the position of a sample is readily determined.

Grab samples drawn from the caves of the sublevel and block-caving stopes are the least reliable. Their weight, determined by the character of ore, is from 20 to 50 lb. As the ore from successive surges or runs from a cave often shows great variation, the best results are obtained by drawing off small amounts of ore at intervals and sampling each drawing. Sizing experiments seem to show that pieces of ore that will pass a ¾-in. ring and remain on a ⅝-in. ring represent average grade of ore, and the bulk of a grab sample is made up of such size.

In development work of importance, face samples are taken after each round, but exceedingly lean or barren ground is sampled only occasionally for future records. In ground requiring close timbering, the stope sampler is expected to take a more careful groove as a substitute for the work of the special sampler. The sampler is held responsible until his assay returns have been so recorded that they may be of immediate use to the stope and shift bosses.

In the stopes the recording is done by tacking a small, heavy paper tag, bearing the assay value, to the timber nearest the place sampled, and also by posting the value on a sample map kept in the stope. A map is made for each slice or stope floor on a scale of 20 ft. to the inch, and shows coördinate lines, chutes and boundaries of adjacent old stopes in ink. It is tacked to a light board and protected from dirt by a canvas flap. As stoping operations progress, the advance work is recorded in lead pencil, assays being posted at the same time.

SAMPLE TICKET USED AT DETROIT COPPER CO.

ORIGINAL	DUPLICATE
Mine.....	Mine.....
Working or Stope.....	Working or Stope.....
Level or Stope Floor.....	Level or Stope Floor.....
Date.....	Date.....
Description.....	Description.....
.....	.....
.....	.....
Assay Value.....	Assay Value.....
Sample No.....Sampler.....	Sample No.....Sampler.....

The same method is used in development sampling, a sheet of cross-section paper fastened to a small board, being hung at the entrance to the working, a survey nail or other permanent point serving as draft mark. Assays are shown in their relative positions in columnar form, and opposite each assay is set down the date and any remark. On completion of the stope floor or development work, the mine maps are placed on file as original records.

Chief Sampler Supervises Sampling and Recording

It is the duty of the chief sampler to see that the samples are correctly taken, that the workings are neither under sampled nor over sampled and that the mine records are promptly and properly posted. This requires him to be underground about two-thirds of the time, office duties occupying the rest. The halves of the sample tickets marked "Original" are sent by the assayer to the chief sampler and from these the office records are posted; the "Duplicate" halves go to the mine sampler.

Stope records are kept in a loose-leaf cross-section book, the records being a duplicate on a smaller scale of the maps hung up in the stopes. For development work a sheet of cross-section paper, covering a month's period, is used. Each working is represented by a vertical column with horizontal columns for dates, the assay value with distance from draft mark being set down opposite its date. The sheet is posted daily and is kept in the mine superintendent's office. From this sheet at the end of the month, permanent entries are made in loose-leaf cross-section books, which group each working by itself, and in addition to assays recorded in relative positions in vertical columns, shows draft mark or initial measuring point, a monthly date, footage, character of ground, etc. Channel samples, which may be supplemented by samples taken in the course of development work, are recorded on 30-scale tracing-cloth maps, a simple form of legend being used to distinguish a sample taken horizontally from one taken vertically or across a drift; colored ink is used where assays have been determined for silica or iron.

On a cost for labor of from $2.50 to $3.25 per day, the following summary is given: Labor, 69% of total; supervision and office, 24%; supplies, etc., 7%; development and stope samples, 29c. each; cost of channeling, 8.8c. per ft.; cost of sampling, 1.2c. per ton of ore.

U. S. Platinum Production

California and Oregon produced all the platinum mined in the United States in 1911, according to report of the U. S. Geological Survey, and this output was $8631 greater in value than the 1910 production. The California production was 337 oz. worth $8386 in 1910, and 511 oz. worth $14,873 in 1911. The Oregon output in 1910 was 53 oz. worth $1121 in 1910, and 117 oz. worth $3265 in 1911. The total production in 1911 was 628 oz., valued at $28.87 per ounce.

Importations in 1911 of crude platinum sands resulted in an estimated refined product of 27,500 oz. An additional amount was derived from imported ores and mattes, the total quantity refined being placed at about 29,140 fine ounces. The platinum imported and entered for consumption in the U. S. in 1911, including ores and manufactured products, was valued at $4,866,207, an increase of $1,212,543 over the 1910 figures.

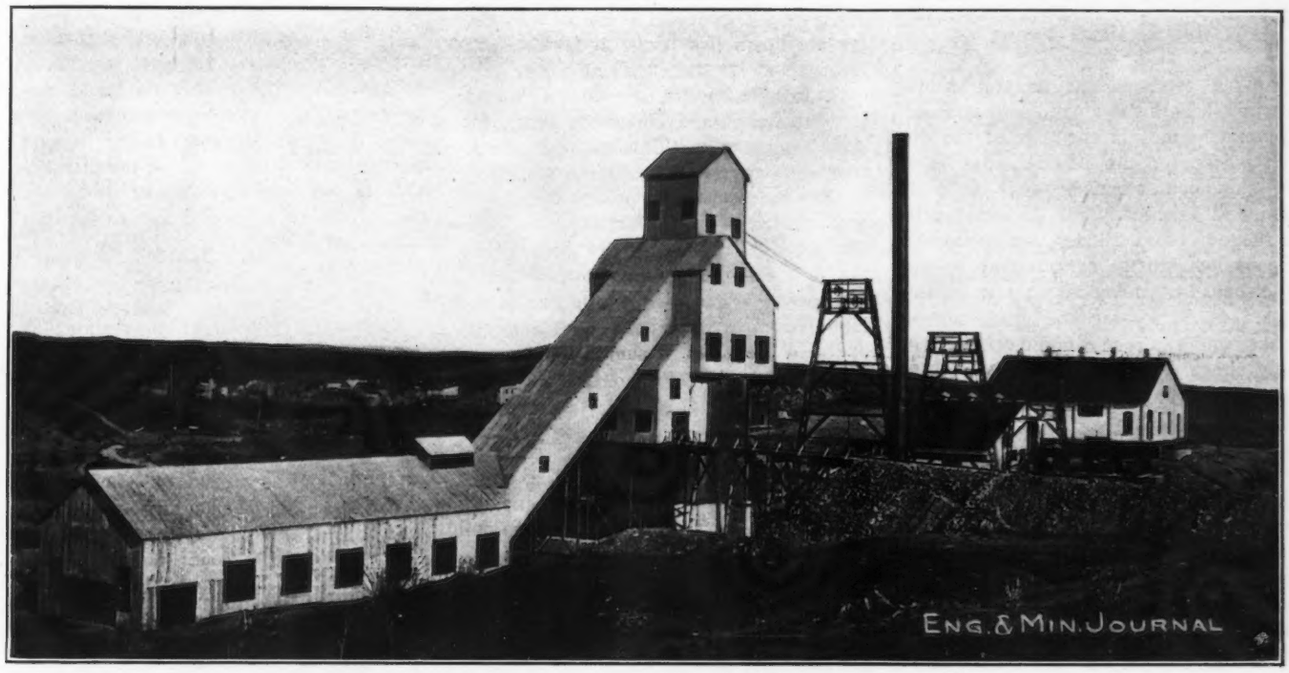
Mining Copper at Lake Superior—VII

By Claude T. Rice

One-man drills are the principal hope for lower costs in conglomerate mines. In amygdaloid mines, the one-man drill, concentration of hoisting and haulage, and earlier robbing of pillars offer opportunity for improvement. Greater level intervals are being tried; also ore chutes extending through several levels to reduce hand tramming.

At the rock houses in the Lake Superior Copper country the ore, which is full of boulders both at the amygdaloid and the conglomerate mines, is crushed down to about 4-in. size before being sent to the mills. At the Calumet & Hecla mines, 24x48-in. Calumet crushers, of the Blake type, are used, while at the ore houses of the other companies, 24x 36-in. crushers are the largest used, being generally of Farrell make. Large boulders are loaded in the skip, many of which the men have to roll into the cars on planks. Indeed one of the characteristics of the stoping practice at the Lake copper mines is the large size of the ore that comes from the stopes, owing to the fact that in the flat mines the ore does not have to be pulled out of box chutes or through mill holes. There is generally an apron in the rock houses at the amygdaloid mines, so that the poor rock can be dumped directly into a separate bin before reaching the grizzly that precedes the crushers, for at those mines a large proportion of the poor rock is hoisted to surface.

Since pillars are left in the stopes, in the hope that it will be possible to come back later and rob them, there is no place where poor rock can be stored underground to advantage. In some of the mines, the Mohawk for instance, poor rock walls are built up along the levels and the waste rock is dumped into some of the old stopes, but most of the poor rock is hoisted to surface, owing to the difficulty of getting it to the worked-out stopes. The Calumet & Hecla company, after getting it on surface, is following the practice of hauling in trains all the poor rock that it cannot sell, to a raise connecting with old stopes near Osceola No. 13 shaft, and dumping the poor rock back into the mine.



NORTH KEARSARGE NO. 4 SHAFT HOUSE

THE ROCK HOUSES

The trap rock which is hoisted at the conglomerate shafts, is not mineralized so much as that at the amygdaloid mines, as it comes from outside the lode, and it therefore makes better building stone as well as better road material. In the ore houses of the conglomerate mines provision therefore is often made for crushing the poor rock into road material. Some of the mines have a steam hammer to aid in cleaning the mass copper that is picked out of the ore at the grizzlies, others use simply a drop hammer. These rock crushers are carried in the ore houses at a height of 40 to 50 ft. from the ground, so that there is a heavy strain on the frame of the building. Formerly the frame was made of wood but the newer ore houses are built with steel frames. The orebin rests on a masonry pier.

As will be seen, the ore houses are built with a low shed extending out from the hanging-wall side of the lode. In this, and on tracks, are kept the extra skips and the man-cars, which have 10 seats each holding three men. By means of counterweighted switches that are lowered to the skip tracks, the skip or the man-car is lowered to the track in this building, the other car connected to the rope, hoisted to the skip tracks and the switch raised out of the way again, permitting changes to be made quickly and easily.

Instead of a number of switches to throw the car from the overhead switch to one of the several tracks in the collar building, a transfer track is used in the North Kearsarge No. 4 shaft, and the floor of the whole house is laid in concrete.

The man-cars at the Calumet & Hecla mines are all equipped with electric storage batteries that furnish power to lamps in order partly to illuminate the car and to throw a light on the hanging of the shaft so that it can be seen easily and any loose pieces of rock readily detected while the men are passing through the

shaft, but of course the primary object is to light up the station while the men are getting on the car.

One of the striking features of the Northern mines of the Lake Superior district is the absence of electric lighting underground on the stations and in the haulage ways. To one accustomed to seeing much electricity used about Western mines, the small use of electricity at these mines is a surprise. There is an electric hoist fitted with a Ward-Leonard control, used underground at the Red Jacket workings, the pumping at the central pumping station for the Calumet & Hecla mines is done by electricity and a few Ft. Wayne electric drills are used in the stopes of the Ahmeek mine, while the crushers at the Calumet & Hecla ore houses are run by electric motors, but in general comparatively little electricity is used. Future development will probably see a much more extended use of electricity at these mines.

Future Development

Having reviewed the general mining practice in both the amygdaloid and conglomerate mines in the part of the district where the dip of the lodes is so low that open-stope methods must be used and practically all the ore, as far as the amygdaloid lodes are concerned, is shoveled into the cars, it may be well to discuss the advances that are going to aid in decreasing the cost at these mines where already mining is suprisingly cheap.

There can be no doubt that many economies are going to be affected in Lake Superior mining in the near future, as only lately have the companies commenced in earnest to experiment in regard to suppliés, types of rock drills and different methods of doing the operations, using trained men to keep track of the experiments so that the latter will show something definite and their outcome will not be a matter of individual opinion, as so often was the case in the past, when the mine captain had the most to say in regard to underground equipment and practice.

Probably the greatest economy that is to come in the near future will be due to the introduction of one-man machines in the stopes. The considerable economy in the cost of breaking the ore that will result in their use is assured by tests that have lasted over a year and it is now only a question of getting the men to use them without any friction arising. Some time must be taken to train the miners to their use, as it is no easy thing for one man to run a machine in these stopes that are from 9 to 20 ft. wide, but probably within two years the two-men drills will be the exception instead of the rule in stoping as well as drifting.

Future Haulage and Hoisting

Another economy that I think is approaching is greater concentration of not only the hoisting but also the haulage at the amygdaloid mines, to do away with the hand tramming. Rope haulage cannot well be used in the amygdaloid lodes because of the crookedness of the levels. The more expensive systems, except possibly haulage with gasoline locomotives when they are perfected for underground use, are out of the question unless the tonnage that is to be hauled is concentrated from several levels on a level below. A series of raises put up along the lode, at intervals of about 500 ft. would be a simple solution of the problem if only they would work, but the experience of the Calumet & Hecla company on the Osceola lode in shooting the ore from level to level indicates that the bottom of these chutes must have an angle of 40°. Still, the ore runs out of the stopes well when it is blasted and an angle of 38° is found sufficient. Sliding the ore down two levels at North Kearsarge No. 4 shaft, where bins are used for storing the ore in the shafts, is practiced and loading into the skips is done with measuring pockets. Of course some ore would cling in the chutes on these flat dips but if they worked they would offer a simple solution of the problem, as by cutting into the foot slightly at the bottom, to get a steeper slope for feeding the ore to the mouth of the chute, and by using air-operated arc gates, it should not be hard to load the cars even with fair sized boulders coming down.

The Critical Angle

There is, however, an angle at which it does not pay to try to slide the ore from level to level in a mine, and mining men with much experience in these mines say that 38° is too low a dip to pay for dumping the ore out of a car and loading it again into another car on another level. They consider that, once the ore is in a car, with the dip as low as 38°, the best thing is to lower it in cars to the other level through subshafts, as is the practice at the Red Jacket workings, and to follow the Red Jacket practice entirely except that electric haulage would be necessary owing to the crookedness of the lode. This is probably the best solution of the problem, but whether measuring pockets, or bins with measuring pockets should be used on these haulage levels, would depend largely on the strength of the hanging and whether the shaft is in the lode or in the foot wall. Some such solution, which does away with long hand trams, is coming. The attempt at concentrating the hoisting by shooting the ore down two levels, as at North Kearsarge No. 4 shaft, where a novel form of measuring pocket works admirably, or of having a chute placed at the edge of the shaft pillar to take the ore down five levels, as at Osceola No. 13 of the Calumet & Hecla, and then drawing it into a 7-ton car and loading the skip on that car, are only experiments that show what is being striven for. If the mining methods cannot be changed so as to permit of the concentration of the mining on fewer levels, then the tramming must be concentrated instead.

The level intervals, I think, can be increased with some gain in economy and operation. At first an interval of about 100 ft. was used but this has been increased at several of the mines to 125 ft. and I believe that it is now planned to develop the lowest 500 ft. of ground in the North Kearsarge No. 4 shaft by three levels. It seems to me that no drawback in the general mining operations would result if a level interval of 150 ft. were to be adopted in all the amygdaloid mines, except that it would be rather hard work packing the tools up to the top of the stope over a floor covered with broken ore. If the level interval is increased it will probably be found better to use chutes for cleaning out the stope as at the Mohawk, rather than to use the other methods where the distance that the ore must be moved down the stope plays an important part in the cost of operation.

Pillars are Left

Another pecularity of the mining is that the hanging wall is left standing on pillars. The intention at many of the mines is to stope all the ore before the robbing of the pillars has commenced. Then the pillars are going to be mined retreating and as much of the ore saved as possible. In the meantime the hanging wall of these old stopes is getting bad and slabby, as the lime minerals in the rock have a tendency to slack and swell whenever the wall rock is at all broken. The floors of the old stopes are also being covered with dribblings of poor rock which will get mixed with the ores from the pillars if mining of the latter is attempted. The blasting in these old stopes will also cause seams to open in the hanging and large pieces will come down when work is resumed after several years have elapsed, either catching some of the miners or scaring them so badly that higher wages will have to be offered to induce them to scram.

Nothing is gained, after a depth of 800 or 900 ft. is reached, by leaving the hanging wall standing on these pillars, except that it is possible to go back into these old stopes and shoot up from the foot, ore once too low grade to mine but rendered profitable by later economies. This is a great advantage as has been shown in the South Kearsarge and the old Osceola workings. But it should be pos-

sible from now on at most of the mines, to take out of the floor of the stopes practically all the ore that it will ever pay to go back after, as the total cost of producing marketable copper in these ores has been reduced to approximately $1.30 per ton of ore hoisted, of which about 85c. is for underground mining, about 30c. being for actual ore breaking. This is cheap mining and a low cost of producing copper, so that the ore which now is left in the footwall must be extremely low in grade if the stoping is carried on properly. Of course there can be no doubt that further economies are going to result in the mining methods, probably along some of the lines I have suggested, but it is going to cost something to reopen some of the old levels and to get them into condition again for mining. Further, the dribblings from the hanging wall that are sure to result with the lapse of time, either will have to be cleaned out of the stope or else permitted to mix with these low-grade scrammings from the foot wall and the better grade coming from the pillars. This is certain to militate against the success of any such general scramming scheme.

Leaving Pillars is Dangerous

The principal trouble in leaving the hanging wall standing on pillars is that the drawing of the pillars is likely to cause difficulties when the robbing commences. Pillar robbing assumes the characteristic of caving methods, in that for the robbing to be successful it must not come in surges. It is essential that one be able to control the caving so that it will not, at any time, extend beyond where it is intended to, and the roof must come at approximately the time desired.

With a strong hanging wall like that characterizing most of the workings now under discusson, it is necessary to undermine a large area and to let it stand a long time before the first caving of any magnitude can be started. If the area of ground standing on pillars is small in proportion to the area that has not been touched, no harm is going to result to the mine when the general movement begins. But if most of the mine is standing on pillars, the general movement is apt to extend over a much larger area than was intended and to surge suddenly and unexpectedly; perhaps cracking pillars under a large area and making those workings unsafe to enter, if not closing them completely. A somewhat similar happening was the cause of the loss of the Atlantic workings only a few years ago. In that mine, owing to the strength of the walls, it had become the custom to mine the ore without leaving many pillars, and what pillars were left were small. Consequently in time, as the hanging wall did not follow down after the mining, there was an immense area of hanging in stress. Air blasts, due to caving of large areas, first appeared, then the real general movement began and it was so extensive that it could not be controlled. So the whole mine was lost. A peculiarity of these adjustments of the hanging wall is that to date they always have occurred on Saturday night or Sundays, when no mining was going on.

Systematic Robbing Necessary

The wisest procedure, therefore, seems to be to cut out the pillars when the mine is young, now that mining and other costs are so low, and the recovery of copper even in the low-grade mines is approaching 80%. In that way the caving of the hanging wall would be started when it could not do much damage to the mine, as little of it would be undercut, and by following up the first general cave with a systematic robbing of the pillars, the final caving could probably be made to follow closely upon the robbing of the pillars and at a fairly regular distance behind the scrammers, as the Cornishman would call the miners who were gouging the pillars. This, though, could only be accomplished by systematic work and with an even rate of advance in the robbing.

It will be noticed that other than the one-man drill, none of these suggestions apply to the conglomerate mines. The truth is that the mining practice on the conglomerate lode is about as far along as it can be advanced with the exception of the use of one-man drills, and the supplying of the men in these hot workings with ice water. Recently it has been found possible to follow the better grade of ore in the wide stopes and not take all the ore from hanging to foot in case some does not pay. Therefore, when the limit of profit is reached in the orebodies, after the change of drilling practice is introduced some other method of mining will have to be used that does not recover so much of the ore in the lode unless noteworthy reductions in surface costs are made. Possibly some form of the caving system will be found best applicable.

For the many kindnesses shown me while in the copper country and the information and assistance which they so kindly gave me, I wish to thank James MacNaughton, general manager, John Knox, general superintendent, and Allan Cameron, underground superintendent of the Calumet & Hecla company, F. W. Ridley, superintendent of the Centennial and Allouez companies, F. H. Haller, superintendent of the Osceola Consolidated, Fred Smith, superintendent and F. W. Hartman, engineer of the Wolverine company, and Willard J. Smith, superintendent of the Mohawk, as well as many of the mine captains.

Tin Deposits of Durango

According to an article by Manuel Rangel in Boletin Oficial de la Camara Minera de Mexico, ann. 3, no. 22, March, 1912, translated by the London *Min. Journ.*, in the Cerro de los Remedios, near the city of Durango, toward the southwest, are some thin contraction veins in rhyolite. The ore appears as small pockets of reniform tinstone; the surface is often covered with small octahedral crystals of an isomorphous mixture of cassiterite and hematite, a mineral invariably accompanying stanniferous deposits in Durango. These mines have been abandoned for a long time.

The mining district of Potrillos, Partido de San Juan del Rio, is well known; some of the veins were produced by fracture, and others by contraction, due to cooling. The filling is made of reniform masses of cassiterite, large kidney-shaped pieces being frequently accompanied by hematite and a reddish ferruginous clay, and associated with pyenite (a variety of topaz) in beautiful rhombohedral crystals, and, very occasionally, with durangite (a fluo-arsenate of sodium and aluminum) in translucid pyramidal (monoclinic) crystals having a beautiful orange-red color. This rare mineral was first met with in La Barranca mine, 18 miles northeast of Coneto, in quartz veins, 6 in. thick, which, when united to the walls, carries large clear crystals of durangite, but when the durangite is associated with cassiterite in a white pulverulent filling the crystals are small and dark.

Ten years ago the Potrillos mines were worked by the Pittsburgh & Mexican Tin Mining Co., which, after spending more than $200,000 gold, extracted only about 1000 tons of ore. About 20 claims are now being worked to advantage by Manuel Enríquez.

In the Sierra de Cacaria are various deposits of cassiterite accompanied by iron oxide. Similar deposits occur in other parts of the state, especially in the Partidos of Mezquital, Nombre de Dios and San Juan del Rio. In the Guadalupe mine (San Juan del Rio) the cassiterite is united with stannite (tin pyrites—the "bell-metal ore" of Cornish miners). In the bottom of the arroyos, tin placers derived from the veins occur, especially at Cacaria, and at Hornitos, Partido del Mezquital.

The import of mica into the United States still exceeds the domestic production, the value of the imports during 1911 being reported by Douglas B. Sterrett, of the U. S. Geological Survey, at $502,163, and the total value of mica produced in this country at $355,804. Most of the 1911 production came from North Carolina, South Dakota and New Hampshire. The principal mica-producing countries are India, United States, Canada, Brazil, Ceylon and South Africa.

Grinding Practice at McKinley-Darragh Mill, Cobalt

By J. G. Mueller*

The mill of the McKinley-Darragh-Savage Mines, Ltd., is the only mill in the Cobalt district, with possibly one exception, which has thus far gone in for coarse crushing in the batteries and the regrinding of a screen-separated oversize direct from the mortars for independent unit treatment.

The bypassing, around the batteries, of primary fines, i.e., mine and coarse-crusher fines, which will pass 0.125-in. screen aperture, is done to some extent in other mills, though the manner of its disposal after roughing treatment varies considerably. Under our system, material that has once passed around the battery never returns to it in any form. The contents are extracted as far as possible and it is then combined with one or another of the regular pulps below the batteries or, in the case of the finest slime, is bagged for shipment. All but minus 150-mesh material (our standard for slime) in the battery pulp passing a 0.375x0.187-in. aperture slot screen, is passed over an impact screen (8-mesh, 0.069-in. aperture) the oversize combining with the tailing from the primary-fines jig (the coarsest and leanest residue of the primary fines). The valuable metal in both products seems to exist principally in nuggets and minute leaf-silver particles with a small proportion of cobalt and smaltite, which exists in the battery oversize component only.

My theory for this condition is that owing to its toughness and to the tenacity with which it adheres to its gangue, when in minute particles, it is not liberated in the mortar. The more friable cobalt, however, disintegrates rapidly while splashing about in the mortar before being discharged. Hence this oversize is composed principally of barren country rock, conglomerate and slate, with native silver imbedded in or adhering to it and requiring only another coarse reduction for its liberation and comparatively simple concentration.

This theory seems to be sustained by the fact that the minus 150-mesh component of this material, after reduction in an 8-ft. Hardinge conical mill, averages 30% lower in value than its sand component, or plus 150-mesh material. The accompanying data are offered to show that a (Cobalt) pulp whose slime component runs lower in value than its sand component, is unusual if not quite contrary to previous experience in this section. These tests, I might state, are not single tests taken for the occasion, but are averages, in some cases covering regular weekly samples for screen analysis of the different pulps.

*Mill superintendent, McKinley-Darragh-Savage Mines, Ltd., Cobalt, Ont.

To proceed from where the two materials combine and leave the impact screen: The material passes through a jigging device which extracts loose nuggets and cobalt particles and then is semi-automatically fed to the conical mill, steel and brick lined, which runs 26½ r.p.m. and carries 4 to 5 tons of 4-in. pebbles. A 24-hour run of feed averages 33⅓ tons with 35 gal. of water per minute, and is composed of 23⅓ tons of battery product (oversize) and 10 tons of jig tailing. The battery product is divided into 55% on an 8-mesh (0.069-in. aperture) screen and 45% through 8 mesh. The jig tailing is divided into 35% on, and 65% through 8 mesh. Both show a trace through 40 mesh. The Hardinge-mill product gives a screen analysis and silver distribution as shown in Table I:

TABLE I—HARDINGE MILL PRODUCT

Mesh	%	Silver, oz. per ton
+ 60	20	34.68
+ 80	15	29.00
+100	10	21.22
+120	10	16.53
+150	5	24.54
—150	40	23.80

An average of 15 tests over a period of 30 days on the minus 150-mesh overflow and the plus 150-mesh spigot product of the 30-in. cone, to which all the pulp passes from the conical mill, shows the minus 150-mesh component to assay 9 oz., against 13 oz. in the plus 150-mesh component or a difference in value of 30%, over an average of 15 tests, in favor of the plus 150-mesh component.

The battery pulp through an 8-mesh, 0.084-in. aperture slot screen in comparison, gives a screen analysis and silver distribution, as shown in Table II:

TABLE II—BATTERY PULP THROUGH 8-MESH SCREEN

Mesh	%	Silver, oz. per ton
+ 60	50	17.60
+ 80	8	23.72
+100	10	29.04
+120	2	34.00
+150	2	31.00
—150	28	26.96

These figures give content of 20.7 oz. on the 150-mesh against 26.96 for the minus 150 mesh, or a difference of 23% in favor of the minus component.

For supplementary comparison the tube-mill product, as shown in Table III, will indicate a similar scale of silver content in a pulp of much lower grade, i.e., 7 oz. Note the marked difference between the plus and the minus 150-mesh components in spite of its impoverishment by having undergone one sand-table treatment.

TABLE III—TUBE MILL PRODUCT AFTER CONCENTRATION

Mesh	%	Silver, oz. per ton
+ 60	15	6.28
+ 80	15	5.52
+100	10	5.72
+120	9	6.52
+150	7	7.16
—150	44	8.20

These figures give a silver content of 6.3 oz. on 150 mesh, against 8.20 on the minus 150 mesh, or again a difference of 23% in favor of the minus component.

As previously stated, the total pulp from the conical mill passes to a 30-in. cone, the overflow passing into the trunk slime launder, while the spigot product is treated on a Deister table where an extraction of 75% is maintained, the tailing going to waste averaging 20% lower in grade than all other combined tailings. The concentrate averages 600 oz. per ton at a 60: 1 ratio of concentration.

Progress of Basic Converting

Converting on basic lining has been making steady advances throughout the last three years until at present only about 20 per cent. of the copper produced in the United States is being converted in the old way. Doubtless the fear of litigation caused many operators to delay the adoption of basic lining. Some plants are using the old acid converter shells with magnesite-brick lining, but in the newer plants the large Peirce-Smith type converters have been adopted. According to the Peirce-Smith Converter Co., over 80% of the copper now produced in this country is being converted either in the Peirce-Smith type converters or on basic lining, under license, in the old acid shells. Installations of the large Peirce-Smith converters have been made at the following plants:

American Smelting & Refining Co. works at Garfield, Utah, Tacoma, Wash., El Paso, Tex., Baltimore, Md., and Perth Amboy, N. J.; Steptoe Valley Smelting & Mining Co., McGill, Nev.; Canadian Copper Co., Sudbury, Ont.; Cerro de Pasco Mining Co., La Fundicion, Peru; Braden Copper Co., Rancagua, Chile; Kyshtim Corporation, Department of Perm, Russia. Additional installations are also being made at the smeltery of the Tennessee Copper Co., Copperhill, Tenn., and at the new works of the American Smelting & Refining Co., at Hayden, Arizona.

Plants which are operating basic-lined converters of the old type are: Copper Queen Consolidated Mining Co. and the Calumet & Arizona Mining Co., Douglas, Ariz.; Old Dominion Copper Mining & Smelting Co., Globe, Ariz.; Detroit Copper Mining Co., Morenci, Ariz.; Arizona Copper Co., Clifton, Ariz.; United States Metals Refining Co., Chrome, New Jersey; Anaconda Copper Mining Co., Anaconda and Great Falls, Montana.

Argentine Mineral Exports

The mineral exports of the Argentine Republic had a value for 1911 of $545,-551, according to the *Pan-American Union*, and were as follows: Copper bars, 645 metric tons; copper ore, 1492 (the value of these two items is about 73% of the total); wolfram ore, 584; borate of lime, 576; onyx, 381; mica, 15; vanadium ore, 217; lead ore, 103 tons; while all else had a value of only $2516.

A Water Cooled Blast Furnace

Cost and details of altering an ordinary iron blast furnace into a water-cooled stack. Considerable economies shown in the operation of the remodeled furnace.

Note—Excerpts from an article in Engineering News, Aug. 22, 1912.

The most recent development in iron blast-furnace linings is the use of furnaces having inwalls with relatively thin linings, cooled throughout by a sheet or jacket of water. One of the earliest installations of this sort was a furnace constructed by Burgers at the Gelsenkerchen Works in Germany, in 1898, and the first installation of the sort in this country was made under the direction of James Scott, in 1908, at the Isabella Furnaces of the Carnegie Steel Co. Other noteworthy thin-lined furnace installations are those of the Illinois Steel Co., constructed and placed in operation early in 1909, and of the Tennessee Coal, Iron & Railroad Co., which was placed in operation during 1911. One of the most recent installations of this sort is that of the Detroit Iron & Steel Co.

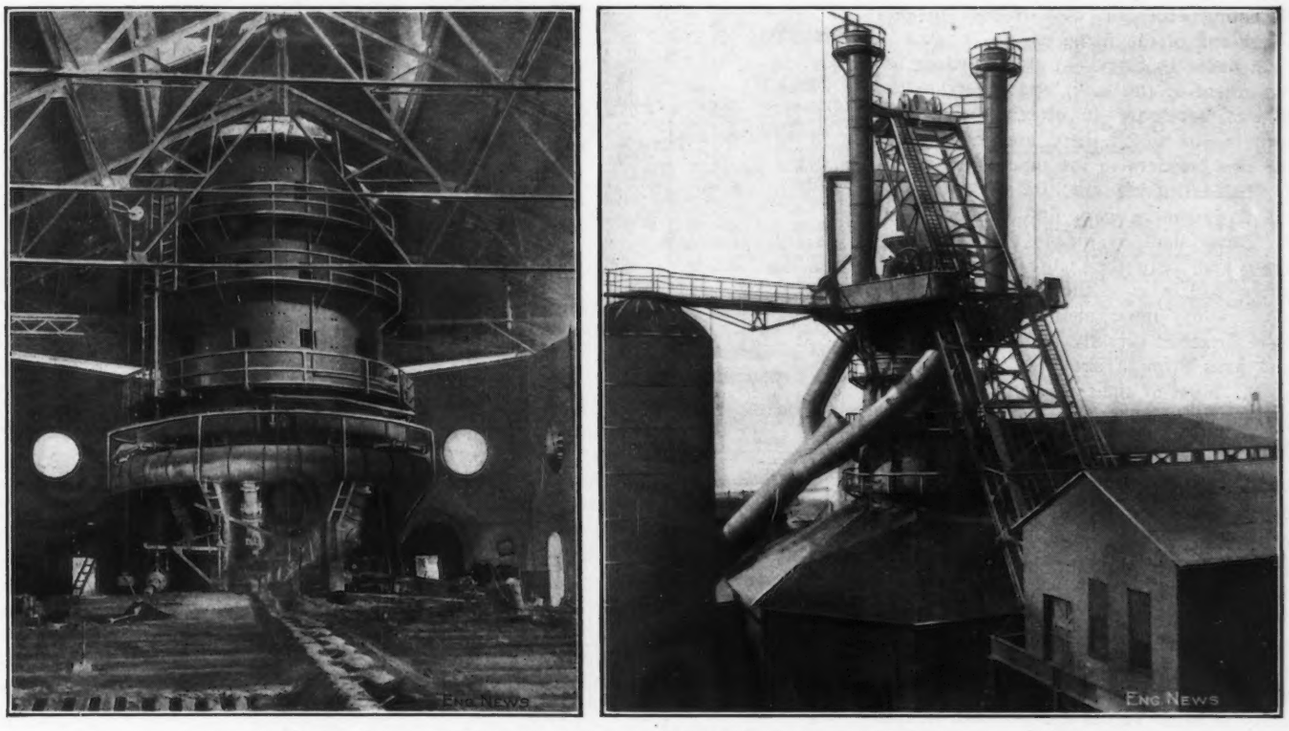


FIG. 1. DETROIT STEEL & IRON CO.'S BLAST FURNACE, RECONSTRUCTED WITH WATER-COOLED THIN LINING

THE DETROIT FURNACE

Two general systems of cooling have been used in connection with thin-lined furnaces, one in which the cooling water circulates in troughs riveted externally to the steel-plate furnace shell[1], and the other in which the cooling is effected by means of circular spray pipes extending entirely around the stack and located at such intervals as to maintain a continuous film of water over the entire shell. The former method is subject to the objection that the cooling water is applied to the shell under some external head which necessitates water-tight joints in the shell construction, for any water admitted to the interior of the furnace would immediately affect its operations and have a destructive effect on the firebrick lining. For this reason, among others, the circular-spray system was adopted for the Detroit Iron & Steel Co.'s furnace.

Early in 1911, this company found it necessary to completely reline their "A" furnace. The stack was originally built in 1902 and has been in continuous operation since that time with the exception of short intervals. The shell had become considerably warped or buckled, so that it was considered necessary, therefore, to provide a new shell if the furnace was to be put into first-class condition. It was decided, however, to reconstruct the furnace with a thin-walled water-cooled construction.

The original furnace shell was composed of nine rings, the top and bottom ones being $\frac{5}{8}$ in., and the seven intermediate rings $\frac{1}{2}$ in. and $\frac{3}{8}$ in. in thickness. In spite of the warping or buckling, it retained enough structural strength to carry the load of the top structure comprising the charging apparatus, etc. It was accordingly decided to retain the old outer shell for this purpose and to build up inside of it a new thin brick lining with a steel shell of its own.

A sectional view of the reconstructed furnace is shown in Fig. 2. The inner shell is of $\frac{3}{4}$-in. steel plate throughout and is supported on an inner mantle ring carried on structural brackets attached to the original mantle columns, which were of substantial construction and in excellent condition. Three angle-iron rings are attached to the inner surface of the inner shell at different elevations to give support to the brick lining.

At the upper end of the shell of the furnace, cast-steel brackets were originally attached to the inside of the shell for the support of the platform. These brackets were retained in their original position, but their ends were cut off to give room for the erection of the new inner-shell top ring, and short lengths of angle iron were fastened across the cut-off end of these brackets as shown in Fig. 2. These angles are not attached to the inner shell, in fact a clearance of about $\frac{1}{4}$ in. is left between the top ring of this shell and the inner flange of the

[1]Eng. and Min. Journ., p. 304; Aug. 17, 1912.

angle. These pieces of angle iron are supposed to bear against the inner shell, if necessary, and maintain the relative alignment of the two shells.

The entire inwall lining in the reconstructed furnace is 12 in. thick and composed of special hard-burned refractories adapted to the purpose. The overall height of the furnace is the same as in the original installation, but owing to the difference in thickness of the brick lining, it was found possible to make the hearth, bosh and stock line diameters 12 in. larger than those of the old furnace.

It should be noted that with the form of construction described, the inner and outer shells are left free for independent vertical movements due to expansion and contraction, and the outer shell, which is not subject to great changes in temperature, serves to hold the inner shell permanently in position at the upper end and prevents the hopper and top from becoming eccentric with respect to the lower end of the furnace.

In order to carry out this freedom of movement of the inner and outer shells, it was necessary to attach the downcomers (of which there are three) and the two bleeders to the inner shell only. In reconstructing the Detroit furnace, the downcomers were first connected to the inner shell by means of plate-work rings and were then cut free from the outer shell so as to allow the free expansion of the inner shell. The bleeders were attached directly to the inner shell and pass through openings in the outer shell. Most of their weight, however, is carried by brackets attached to the outer shell.

Cooling System

The spray system of cooling is used. As shown in Fig. 2, there are six circular spray pipes surrounding the inner shell of the furnace. These pipes have spray orifices, ⅛ in. in diameter, spaced 6 in. c. to c., and are connected to four vertical supply pipes, arranged to give the most uniform pressure possible at the spray orifices. Valves are provided in the connections to the supply pipe to permit any necessary regulation of the flow of water. In this way a film of water is maintained over the entire surface of the inner shell. The thickness of the film is increased by each circular spray as the water passes downward, giving the greatest cooling effect at the lower part of the inwall where the heat is greatest. A trough is attached between the two shells just above the upper mantle ring, in which the cooling water collects. Discharge openings from this trough are provided which connect to the sewer system.

Besides acting as a support for the charging platform and top structure, the outer shell of the furnace serves perfectly as a windshield for the water spray, making it certain that the film of water will be continuous over the whole surface of the inner shell. Six galleries are bracketed to the outside of the outer shell at the levels of the six circular spray pipes. Workmen, standing on the galleries, can inspect or reach the spray pipes, if necessary, through rectangular openings cut through the outer shell. These openings, of which there are twelve at each gallery level, can be seen in Fig. 1.

Operating Results

The reconstructed furnace was blown in early in December, 1911, and has given since that time exceptionally good results in operation. We are informed by Arthur G. McKee, of Cleveland, Ohio, who had charge of the reconstruction work, that the tonnage has been increased about 24% with the reconstructed furnace

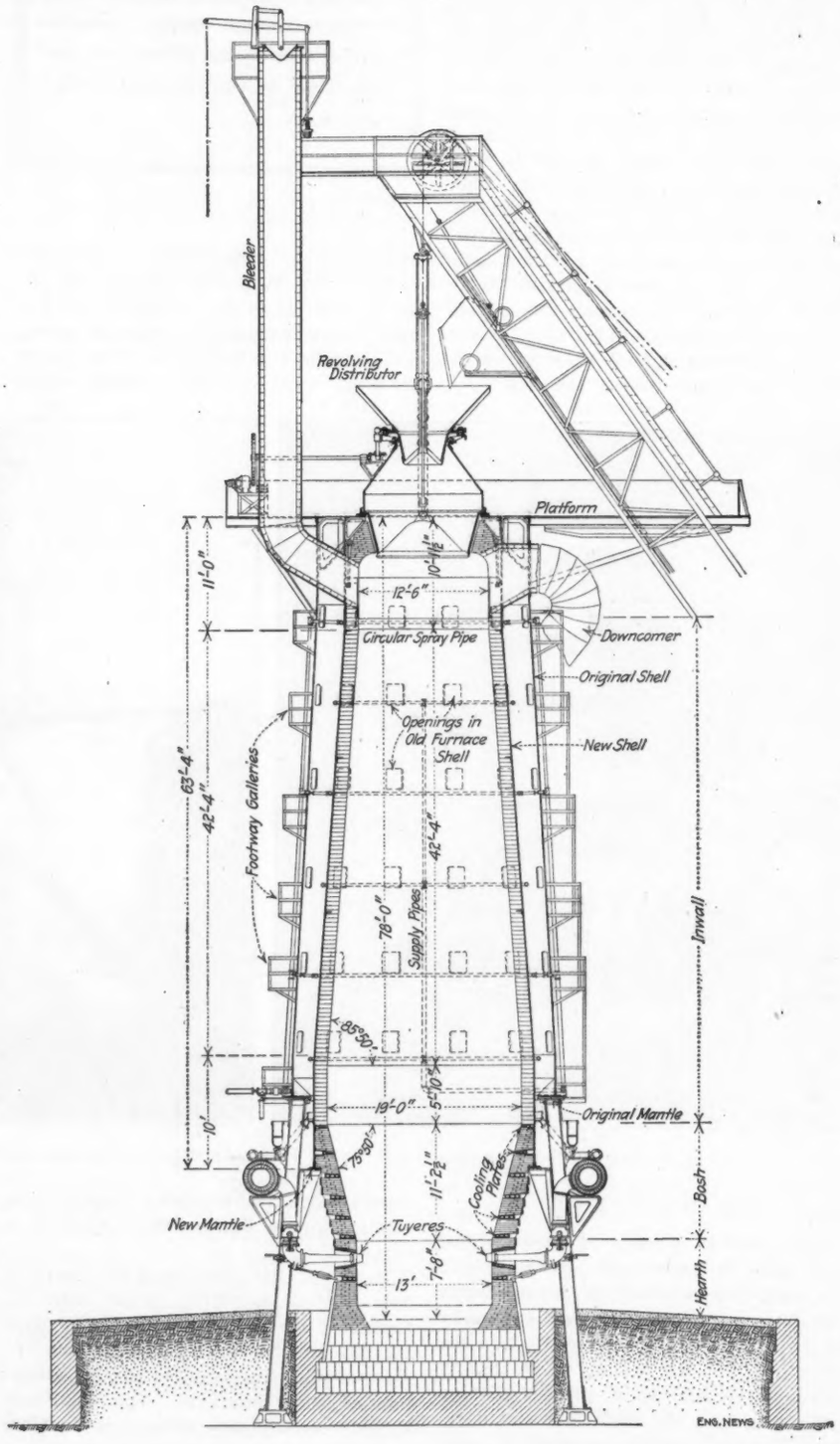


Fig. 2. Sectional Elevation of the Detroit Water-cooled Blast Furnace

compared with the average tonnage made by the original installation during the seven years previous. This increase he ascribes in part to the increased diameter of the stack, but also to the remarkable regularity of operation resulting from the water cooling.

The fuel used in this furnace has always been byproduct coke. When operated as a thick-lined furnace, it was impossible to carry a burden-to-fuel ratio of more than 1.7, but with the new construction this has been increased to over 2. The furnace is operated on merchant iron and has encountered the necessity of frequent change of product as is usual in furnaces making iron for the open market. The quality of the iron has been remarkably uniform, no difficulty being encountered in maintaining the sulphur contents under 0.04 with a range of silicon of from 0.75% to 3%. It is stated further that the furnace responds with great promptness to any changes of burden.

Cost of Reconstruction

One of the chief objections to the rebuilding of blast furnaces as water-cooled stacks has been the high first cost. This was due to the fact that with a thin lining it became necessary to provide a separate support other than the furnace shell for the skip bridge, top structure and platform, as well as for the inspection galleries outside of the shell. This supporting structure was usually made in the form of steel columns resting on the mantle ring and extending from there to the top platform. Mr. McKee estimates the cost of reconstructing a furnace by the method applied to the Detroit furnace as described at approximately $30,000 to $32,000—not materially more than is required for the relining of a thick-lined furnace. The amount given is for a furnace 20x80 ft. in dimensions. This cost covers the steel work, including the inner shell with its mantle and supporting columns, the galleries and all necessary alterations to the existing outer shell, connections of existing bleeders and downcomers, spray piping, brickwork and other incidental alterations. It is here assumed that the mantle columns are reasonably adapted to the support of the inner shell and that the outer or existing shell has sufficient strength adequately to support the load which it has previously carried without reinforcement.

The time necessary for converting a furnace of this size to a thin-lined installation, assuming that drawings are prepared and material and construction contracts placed before going out of blast, should be approximately nine weeks and should not exceed 12 weeks, unless unusual construction difficulties are encountered.

Reconstruction along the lines described provides to all intents and purposes a new surface stack, the useful life of which should fully equal the original installation. Relining can be accomplished over a long period of operation with a saving of from one-half to two-thirds of the corresponding cost for a thick-lined furnace and with a saving in time.

The reconstruction of the Detroit Iron & Steel Co.'s furnace was carried out under the direction of Mr. McKee under patents issued to M. McMurray, manager of furnaces for the M. A. Hanna Co., of Cleveland, Ohio.

Burmese Petroleum Industry

The production of petroleum in Burma during 1911, although less than the record year of 1909, shows a considerable increase over 1910, as appears from the accompanying tabulation. (*Daily Consular and Trade Reports*, July 25, 1912.)

BURMESE OIL PRODUCTION IN IMPERIAL GALLONS [1]

Fields	1910	1911
Yenangyoung	174,967,298	166,494,319
Singu	31,524,175	50,564,765
Yenangyat	4,942,308	4,476,074
Minbu	18,320	632,458
Kyaukpyu	33,544	36,970
Akyab	22,258	19,630
Thayetmyo	.....	1,315
Total production	211,507,903	222,225,531
Total value	$3,958,820	$4,188,590

[1] British imperial gallon = 1.2 American gallons.

The Yenangyoung field annually decreases in production and will probably continue to do so, as this region has been worked to an almost destructive extent. The Singu field, for the first time in several years, increased its output. It is probably capable of a greater production than the figures seem to indicate.

The output of the Yenangyat field has steadily declined from 18,700,000 gal. in 1905, to 4,476,074 gal. in 1911. On account of topographical features this is an expensive field to work. Yenangyat oil contains little wax, and for that reason is not so valuable as the oil in other districts. "The falling off in production," according to Sir Thomas Holland, "is not necessarily a certain indication of failing resources, but it simply means that the companies concerned have devoted their main energies to richer areas."

In 1910 a rich stratum of oil was struck in the Minbu field by the Burma Oil Co. One well at a depth of 630 ft. had an initial output of 400 bbl. per day. The British-Burma Petroleum Co. is also working in this field.

The Indo-Burma Petroleum Co. is now drilling several wells off the Chindwin River in the direction of Kindat. Should oil be struck in working quantities, there would be a large increase in the production of Burma oil. A pipe line will have to be constructed to get this oil out, as there are no means of transportation.

The exports of petroleum and petroleum products from Rangoon during 1911, had an aggregate value of $17,864,920. The imports of American kerosene into Rangoon have increased from $193,374 in 1909, to $202,328 in 1910, and $276,557 in 1911. This steady advance is most satisfactory when it is considered that Burma is itself an oil-producing country. Up to the present, however, the Burma oil companies have not been able to produce a nonsmoking kerosene of high grade.

American oil is used almost exclusively by the European communities, while the natives use the cheap local oil. The increasing use of electric light in Rangoon and other cities of Burma is bound, however, to bring about a reduction in the use of American oil. The Burma Oil Co. has just put on the market its "Waterlily" brand, which is being extensively advertised throughout India as a "fine water-white oil, 150° fire test, equal in every respect to the best imported oils." At present this new kerosene has had no effect on the sales of American oils, but probably will do so in the future as it becomes better known.

Beaver Consolidated Mines

The Beaver Consolidated Mines reports for the quarter ended May 31, that 1244 ft. of development work were done, 855 ft. of drifting, 330 of crosscutting, 43 of sinking and 16 of raising. Stoping amounted to 1076.5 sq.yd. Results of development work have been satisfactory. The main shaft is now down 590 feet.

The mill ran steadily from Mar. 18, and two cars of concentrates have been shipped, one from the dump and one from above ground. A summary of the work from Mar. 18 to May 31 is: Tons milled, 3786; head assay, 26.1 oz.; tail assay, 4.1 oz.; cost per ton, $1.88; tons concentrates, 67.832; recovered, 84,438.4 oz.; extraction, 84.4%. Figuring on 52c. per oz., the net milling profit was $36,896. [The average price of silver at New York was over 58c. per oz. during this period.—Editor.] The mill was built to handle 50 tons per day, but is exceeding this.

The Erie Cobalt property, consisting of 40 acres, was purchased for $1500. Part of the property underlies Kirk Lake, which supplies the water to the Beaver mill, and it was to conserve water for milling purposes that the property was acquired.

It is estimated that there are 8,000,000,000 tons of mineable coal in the Black Mesa fields, of Arizona, says a U. S. Geological Survey bulletin, and probably 60,000,000 more in the Deer Creek field of the same state.

Sulphur Determination in Pyrites

By Albert M. Smoot*

A new electrochemical method for the exact determination of sulphur in pyrites.

The heavy metals are removed by electrolysis from the solution, leaving a practically pure solution of sulphuric acid to be worked with. Disadvantages of the modified Lunge's method given, with a comparison of results by this and the electrolytic method.

*Ledoux & Co., 99 John St., New York.

Someone has wisely said that the commercial prosperity of a nation may be gaged by the amount of sulphuric acid consumed. Since pyrites is the raw material from which by far the greater proportion of sulphuric acid is produced, it also might serve as a guide to commercial prosperity, and the exact determination of the sulphur contained in it is important, not only on account of the large amounts involved in the purchase and sale of the ore, but also because exact knowledge of the sulphur tenor of the raw material affords a close control of manufacturing operations.

Modified Lunge Method

Heretofore the Lunge method, with or without certain modifications, has been generally used, at least in this country, for the determination of sulphur in pyrites. Briefly, this method consists in the wet oxidation of the finely ground pyrites with a mixture of hydrochloric and nitric acids, followed by evaporation to dryness on a steam bath, whereby the sulphides are converted to sulphates and free sulphuric acid. In order to expel all nitric acid, the dry residue is treated with excess of hydrochloric acid and again evaporated to dryness. The residue from the second evaporation is treated with a very little hydrochloric acid, dissolved in water and the iron is separated as hydrate by the addition of ammonium hydrate in excess. The iron hydrate is removed by filtration and thoroughly washed. The alkaline filtrate and washings, containing all the sulphuric acid, together with most of the copper and zinc which may have been present in the pyrites, is made slightly acid with hydrochloric acid and the sulphur is precipitated from the hot solution as barium sulphate by the addition of barium chloride. The barium sulphate is filtered, washed, ignited and weighed.

There is a wide-spread belief that the Lunge method determines only the available sulphur; i.e., the sulphur present as sulphides of iron, copper and zinc, to the exclusion of sulphide of lead and sulphate of calcium. As a matter of fact, it does nothing of the kind, since both sulphide of lead (after oxidation to sulphate) and sulphate of calcium, in the amounts in which they occur in any mineral likely to be marketed as pyrites, are fully soluble in the hydrochloric acid, water and ammonium chloride used in the method. The sulphur of these compounds is obtained in the final solution and the only sulphur not included is that which may have been present in the ore as baryte, heavy spar. This is a comparatively rare constituent of pyrite ore, and the sulphur contained in it is, of course, quite useless. Unfortunately, the precipitation of barium sulphate from alkali sulphate or ammonium sulphate solutions is not the simple operation that it seems to be; in fact, it is practically impossible to precipitate pure barium sulphate from such solutions and the sources of error are greater with ammonium than with either sodium or potassium salts. The causes and extent of these errors have been fully investigated by Allen and Johnston[1].

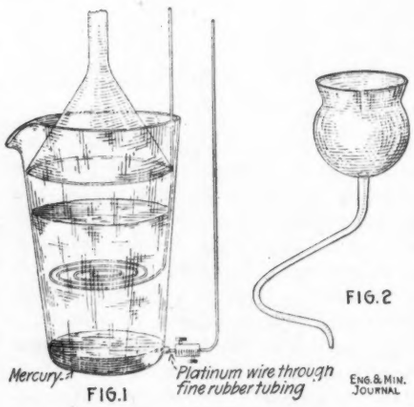


FIG. 1 FIG. 2

Sulphur-determination Apparatus

These chemists have shown that the three principal sources of error are: (1) Solubility of the precipitate in acid liquids, the amount of solubility varying directly with the proportion of free acid. (2) Co-precipitation of alkali or ammonium sulphate and probably coprecipitation of acid sulphates of the alkalies or ammonia with the barium sulphate, the amount of the coprecipitated salts varying directly with the amount of alkali or ammonium chloride in solution. (3) Coprecipitation of barium chloride with the barium sulphate, the amount varying with the rate at which the precipitant is added to the sulphate solution.

The first of these errors is small, unless the amount of free acid present is unusually large, but it is always in the direction of low results. The second source of error also produces low results because a part of the sulphur is precipitated as alkali or ammonium sulphates, and inasmuch as both potassium and sodium have lower atomic weights than barium, the resulting precipitate will weigh less than if it were all barium sulphate. If ammonium is the base, the case is worse, because any ammonium sulphate is volatilized on igniting the precipitate.

The third source of error, occlusion of barium chloride, is always positive; it tends to counteract the first and second errors in two ways—by its own direct weight and by reaction, upon ignition of the precipitate, with the "free acid" of co-precipitated acid sulphates whereby barium sulphate is formed and hydrochloric acid expelled.

In the light of this knowledge, it is not difficult to see that correct results can only be obtained by the nice balancing of plus and minor errors against one another, and that, especially from ammonium-sulphate solutions, the results are apt to be too low. It is, however, quite possible, even in the case of ammonium-sulphate solutions, to obtain results which are practically correct, but this can only be attained by most carefully limiting the amount of ammonium chloride and free acid and regulating the manner of adding the barium chloride in such a way that the occluded precipitant will compensate for the occluded ammonium sulphate, which is lost on ignition or by using a correction factor.

Obviously, this empirical procedure is unsatisfactory. The "correcting error" or the addition factor must be based on careful determinations on mixtures of known compositions, under conditions which must always be exactly followed in every subsequent analysis; any departure from these conditions will tend to vitiate the results.

The New Electrolytic Method

The following method for the determination of sulphur in pyrites depends upon the electrolytic separation of iron and all other heavy metals (except excess lead) from a solution produced by wet oxidation of the pyrites, by means of a mercury cathode, leaving a practically pure solution of the sulphur, as sulphuric acid, to be precipitated as barium sulphate.

The advantages of the method are: (1) In the purity of the solution to be precipitated. It contains no salts of any kind except such small amounts of sulphates of alumina, lime or alkalis as might be derived from the presence of these bases in the pyrites itself. Iron, copper, zinc, lead (to the extent of 10 or 12 mg.) and other heavy metals, are completely elim-

[1] "The Exact Determination of Sulphur in Soluble Sulphates," Journ. Am. Chem. Soc., Vol. 32, p. 588.

inated from the solution. (2) This condition is accomplished, not by the addition of chemical reagents which may be more or less impure and the use of which requires judgment and skill on the part of the operator, but simply by the action of the electric current which introduces no impurities or extraneous matters whatever. (3) By the action of the current under the conditions to be described, the solution is brought automatically always to precisely the same conditions. Precipitation of the barium sulphate is, therefore, conducted always under the same conditions and these are invariable and cannot be affected by inattention on the part of the operator. (4) The method is simple and easy, requiring little time. (5) So far as test analyses have been made by working on pyrites, pure sulphuric acid and pure salts, the results are shown to compare closely with theoretical requirements.

When pyrite, FeS_2, is oxidized in the wet way, the sulphur products are ferric sulphate, $Fe_2(SO_4)_3$, and free sulphuric acid, H_2SO_4.

$$2\,FeS_2 + 15\,O + H_2O = Fe_2(SO_4)_3 + H_2SO_4$$

Two molecules of pyrite produce one molecule of ferric sulphate and one molecule of H_2SO_4. Oxidizing agents may be completely expelled by evaporating the solution to dryness. Zinc, copper and lead, when present as sulphides, do not yield free sulphuric acid by oxidation, but only normal sulphates. Nevertheless, the wet oxidation of any commercial pyrites will yield free sulphuric acid proportional to the amount of FeS_2 present. The solution obtained by treating oxidized pyrites with water, after the volatile oxidizing agents have been expelled by evaporation to dryness on a steam bath is, then, a solution of normal metallic sulphates slightly acid with H_2SO_4. From such a solution, all of the heavy metals may be removed by electrolysis using a mercury cathode for the collection of the electro-deposited metals. After electrolysis, the liquid consists practically of pure dilute sulphuric acid.

Details of Manipulation

Treat 0.5 gram or half a factor weight (0.6868 gram) of the dried sample, ground through 80 mesh, but not finer, in a 250-c.c. beaker with 12 c.c. of a mixture of three parts of nitric acid (sp.gr. 1.42) and one part of hydrochloric acid (sp.gr. 1.20), to which four or five drops of bromine have been added. Cover the beaker with a well-fitting watch glass and let it stand at room temperature for half an hour. Transfer the beaker to a steam bath and heat it gently until all apparent action has subsided, then raise the cover and evaporate the liquid to dryness. To insure the complete expulsion of nitric acid, add 5 c.c. of hydrochloric acid to the dry residue, replace the cover and heat until all effervescence ceases, then raise the cover, wash it and the sides of the beaker with a little water and again evaporate to dryness. Further dehydration is unecessary.

Treat the residue with 25 c.c. of hot water and stir until it is disintegrated—complete solution is unnecessary. By means of a wash bottle, transfer the solution and residue to the mercury-cathode electrolytic-precipitation beaker shown in Fig. 1, dilute the solution to about 75 c.c., connect the beaker with a suitable source of current so that the platinum spiral serves as the anode and the mercury as the cathode and pass a current of 0.8 to 1.0 amp. through the solution for five or six hours. If desired, a weaker current may be allowed to act over night. Iron and all other metals pass into the mercury.

After the electrolytic separation is complete, wash down the funnel and the sides of the apparatus with a little water and decant the liquid into a 300-c.c. beaker. No special haste is necessary in this operation, since the electro-deposited metals are protected by the mercury and the acid solution is weak; consequently, there is little tendency for the metals to redissolve. Pour off the liquid as closely as possible (a siphon may be used if desired), wash the beaker and mercury with 25 c.c. of cold water, decant this into the main solution, repeat this operation four times. Pour the mercury into a small beaker from the "off side" of the electrolytic beaker and wash the electrolytic beaker out once with a wash bottle, paying particular attention to the lip.

The solution, of course, contains the insoluble matter from the pyrites. Filter it through an 11-cm. paper into an 800-c.c. beaker and wash the residue and paper four or five times with hot water. Dilute the solution to 450 c.c. (600 c.c. if half a factor weight of sample is taken), heat it to boiling and while boiling continues add 25 c.c. (34 c.c. for half a factor weight) of a 10% solution of barium chloride in a thin stream.

Method of Adding Barium Chloride

The barium-chloride solution is best added by means of the precipitation pipette, shown in Fig. 2. This is made of a large thistle tube, the stem of which is bent twice in such a way as to reach beneath the watch-glass cover of the beaker through the space at the lip, while the body of the pipette is supported on the watch-glass cover by a cardboard or wire frame.

The stem of the precipitation pipette should be drawn out so that 25 c.c. of liquid will be delivered in five minutes. All pipettes should be graduated to the same time delivery.

After precipitation of the $BaSO_4$, set it aside for several hours, until the solution is cold. Pour the clear liquid through an 11 cm. S. & S. No. 590 filter paper, decanting as closely as possible without disturbing the precipitate. Pour 100 c.c. of hot water on the precipitate and agitate the beaker thoroughly so that all of the precipitate is disturbed and comes into contact with the hot water. Let the precipitate settle for about 10 minutes and pour the liquid through the filter, decanting as closely as possible. Pour 100 c.c. more of hot water on the precipitate, agitate it and let it settle as before, decant the liquid through the filter, let the latter run dry, and then by means of a wash bottle, transfer the precipitate to the filter, clean the beaker with a rubber tipped rod and wash the precipitate and filter six times with hot water. Transfer the moist filter to a weighed platinum crucible, dry it over a low flame, burn the filter at a low temperature and ignite the $BaSO_4$ to constant weight.

A Gooch crucible may be used instead of the paper filter, washing by decantation in the same way and then five or six times on the Gooch. Time may be saved in this way if only two or three filtrations are to be made, but half a dozen filtrations and washings may be conducted at the same time if paper filters are used.

Composition of Barium-Sulphate Precipitate

The weighed barium sulphate obtained in this way is not absolutely pure. Invariably it contains a small amount of barium chloride, which repeated experiments have shown, is equivalent to from 0.06% to 0.09% of sulphur, on the basis of half a gram of pyrites.

Several investigators have shown that when pure dilute sulphuric acid is precipitated by barium chloride, some of the precipitant is always occluded by the precipitate. It cannot be removed by any amount of washing. But this occlusion is not necessarily productive of high results. The solubility of barium sulphate in water and dilute hydrochloric acid produces a compensating error, insufficient, it is true, fully to counterbalance the weight of occluded barium chloride, but which, under the conditions given herein, amounts to about 2 mg., equivalent to 0.05% of sulphur on the basis of 0.5 gram of pyrites. This has been determined by evaporating the filtrates and washings from barium sulphate precipitations to dryness in platinum, recovering the barium sulphate by redissolving the residue in water. Subtracting the minus error, due to soluble barium sulphate from the plus error due to occluded barium chloride, leaves a plus error of from 0.01% to 0.04%. The maximum final error represents 1.5 mg. of barium sulphate on the basis of 0.5 gram of pyrites, the minimum only 0.4 mg.

It is not difficult to imagine that these small weights may be accounted for by loss of the precipitate through incomplete removal from the sides and bottom of the

large beaker, through slight loss during ignition, due to action of gases produced in burning the filter or through a slight reduction to barium sulphide by the action of the same gases on the precipitate. It is difficult to imagine that some such losses as these would not occur in handling from 1.4 to 1.8 gram of a heavy precipitate in large vessels, however carefully the work might be conducted. Presumably, there is a small minus error due to mechanical loss, which, in addition to the solubility error, practically counterbalances the plus error due to barium chloride. Whether this is the real explanation or not, it has been found in standardizing pure dilute sulphuric acid prepared for the purpose of checking this method, that barium sulphate precipitation gave results agreeing closely with titration by pure sodium carbonate and also with the ammonium sulphate method. In making this comparison, the weights of barium sulphate and ammonium sulphate obtained and the weight of sodium carbonate used, were calculated to the vacuum basis.

Results by the New Method

A few examples of the results obtained by the new method are included in the following tables. In comparing the new method with the modified Lunge method, the greatest care was taken in the latter to limit the amount of free acid and ammonium chloride present in the final solution. This was done by using only 0.3 c.c. of strong HCl in treating the dry residue after evaporating to dryness and by boiling out the excess of ammonia from the filtrate from the iron separation before adding the 0.5 c.c. of HCl required to produce the necessary acidity, but no correction factor was added to the results obtained by the modified Lunge method. In precipitating the $BaSO_4$, the same conditions of dilution and the same method of adding the barium chloride by means of the precipitation pipette were employed in both methods.

In the following experimental analyses, pure dilute sulphuric acid was the source of sulphur. The sulphur tenor per gram of acid was found by weighing as ammonium sulphate, by titration against pure sodium carbonate and by weighing as barium sulphate. The weights of $BaSO_4$, $(NH_4)_2SO_4$ and Na_2CO_3 were calculated to the vacuum basis.

By the ammonium-sulphate method, the sulphur value of one gram of acid was found to be 0.008996 gram; by sodium-carbonate titration, 0.008988; by precipitation as $BaSO_4$, 0.008996 gram. The arithmetical average of these, 0.008993 gram, was taken as the standard.

Weighed quantities of the acid, equivalent to about the amount of sulphur which might be found in 0.5 gram of good pyrites ore were used. In each experiment 0.25 gram of pure metallic iron was dissolved in dilute nitric acid and added to the sulphuric acid, the mixture was evaporated on the steam bath to dryness and the remainder of the operation was conducted exactly as described in the method.

Sulphur taken Gram	Sulphur found Gram	Difference Gram
0.2478	0.2476	—0.0002
0.2527	0.2528	+0.0001
0.2511	0.2514	+0.0003
0.2347	0.2348	+0.0001

In the following experiments, the copper in pure recrystallized copper sulphate was determined electrolytically. This can be done easily with a maximum error of 0.05% of the copper contents equivalent to 0.013% on the basis of the salt. The relation of copper to sulphur was calculated and weighed quantities of the salt were dissolved in water and treated as described in the method.

Sulphur taken Gram	Sulphur found Gram	Difference Gram
0.2548	0.2547	—0.0001
0.2544	0.2548	+0.0004
0.2542	0.2542	none
0.2550	0.2542	—0.0008

In the following experiments the new method was compared with the modified Lunge method, as described above, working in pyrites.

ANALYTICAL RESULTS ON PYRITES

Sample No.	Modified Lunge Sulphur %	New Method Sulphur %
1	47.78%	47.96
	47.75%	48.02
2	49.91	50.01 (half factor weight)
3	49.64	49.83
	49.64	49.87
	49.67	49.87
	49.66	49.81

The effect of impurities was tested on ore No. 3. In the first experiment under this head it should be noted that the 5 c.c. of HCl used is practically eliminated on electrolysis.

EFFECTS OF IMPURITIES ON RESULTS

5c.c HCl added before electrolysis	49.88
10 mg Pb added before dissolving	49.83
10 mg. Pb and 5 c.c. HCl, as above	49.85
40 mg. Pb and 5 c.c. HCl	49.83
50 mg. Pb and 5 c.c HCl	49.52
50 mg. Pb. no HCl	49.30

Lead to the extent of 10 mg. in 0.5 gram of ore does not interfere with the accuracy of the method, as the lead sulphate is decomposed by electrolysis. If a little HCl is added to the solution before electrolysis, the decomposition of lead sulphate is promoted. As much as 40 mg. of lead does not appear to interfere with accuracy. The HCl is practically eliminated by allowing the current to act over night. More than 40 mg. of lead appears to be deleterious.

It will be seen from the above figures that the new method yields practically theoretical results when working on known quantities of sulphur. In comparison with the modified Lunge method—the determinations of which were made with the greatest possible care, but without the addition of any corrections—the new method is about 0.18% higher. The modified Lunge method without corrections is known to be a little too low.

Another feature of the new method lies in the possibility of determining sulphur volumetrically by titrating alkalimetrically the acid liquid either immediately after electrolysis or the liquid after removing sulphuric acid by precipitation with neutral barium chloride.

A few experiments indicate that either procedure will yield quite accurate results with pure pyrites ores, but the solution obtained by oxidizing the ore and evaporating to the dryness on the steam bath must be repeatedly dissolved in water and re-evaporated to eliminate every trace of HCl before electrolysis. The volumetric modification is, of course, not available in the presence of alumina or lime in the sample. The gravimetric method given above is generally applicable. It is recommended to those who may be interested in the accurate analysis of pyrites.

Mineral Paints in 1911

The production of mineral paints in 1911, is reported as follows, by the U. S. Geological Survey: Ocher, 11,703 tons; umber and sienna, 1005; metallic paint (ground natural oxides of iron, roasted carbonates of iron, blast-furnace flue dust, blue billy, etc.), 25,599 tons; mortar colors (ground blue billy slate, shale, culm, etc.), 7922; ground slate and shale not used as mortar colors, 16,510 tons. Except in the metallic-paint and mortar-color productions, which decreased by 3823 and 2038 tons respectively, these figures are almost the same as in 1910, the aggregate decreases in the other items amounting to 23 tons.

Usually a small amount of shale is distilled in the United States each year, but there was no production reported in 1911. Whiting was produced in only two states, Kentucky and Missouri. California, which usually reports a production, made none during the year. There was a production of 80,611 tons of pigments made from ores, which include sublimed blue lead, sublimed white lead, leaded zinc oxide, and zinc oxide. The franklinite ores of New Jersey are largely used for these pigments by the New Jersey Zinc Co., smithsonite by the Mineral Point Zinc Co., and Galena and blende are also used.

The production of chemically manufactured mineral paints is as follows: Basic-carbonate white lead, 132,612 tons; red lead, including orange mineral, 20,306; litharge, 25,190; lithopone, 16,866; Venetian red, 5773 tons.

A recent addition which has been made to the equipment of the Colorado School of Mines is a new 14-ft. Littrow spectrograph, purchased at a cost of $15,000, through the Vinson Walsh research fund.

Mining and Metallurgical Patents

A Classified List of New Inventions

A copy of the specification of any of these patents issued by the United States Patent Office will be mailed by "The Engineering and Mining Journal" upon the cereipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

GOLD AND SILVER

AMALGAMATOR. Frank W. Lewis, McLeod, Mont. (U. S. No. 1,034,259; July 30, 1912.)

AMALGAMATOR. George H. Woodhouse, Seattle, Wash., and Wilfred L. Brown, San Francisco, Cal. (U. S. No. 1,034,051; July 30, 1912.)

DRY SEPARATOR AND AMALGAMATOR. Joseph B. Hartman and Philip O. Cummiskey, St. Louis, Mo.; said Cummiskey assignor to said Hartman. (U. S. No. 1,034,792; Aug. 6, 1912.)

GOLD FROM CLAY—Process for the Extraction of Gold from Clay. Jacobus Jan Willem Hendrik van der Toorn, The Hague, Netherlands. (U. S. No. 1,033,359; July 23, 1912.)

STAMP MILLING—Pneumatic Stamping Plant. Hans Charles Behr, Johannesburg, Transvaal. (U. S. No. 1,034,863; Aug. 6, 1912.)

STAMP SHOES—Method of Making Manganese-Steel Stamp Shoes. Frank A. Haughton, High Bridge, N. J. (U. S. No. 1,033,800; July 30, 1912.)

IRON AND STEEL

ALLOY STEEL—Process of Producing Alloy Steel. Albert E. Greene, Chicago, Ill., assignor to American Electric Smelting and Engineering Co., St. Louis, Mo. (U. S. No. 1,034,786; Aug. 6, 1912.)

BLAST-FURNACE-COOLING DEVICE. Frank C. Roberts, Wynnewood, Penn. (U. S. No. 1,030,792; June 25, 1912.)

CONVERTER. S. B. Trumkin, Minsk, Russia. (U. S. No. 1,025,260; May 7, 1912.)

GAS WASHER. Mark W. Johnson, Jr., Birmingham, Ala. (U. S. No. 1,034,463; Aug. 6, 1912.)

HARDENING—Process of Case-Hardening Steel. Kirk Blake, Laporte, Ind. (U. S. No. 1,034,962; Aug. 6, 1912.)

MANUFACTURE—Process of Manufacturing Steel from Crude Iron. Henry D. Hibbard, Plainfield, N. J. (U. S. No. 1,035,120; Aug. 6, 1912.)

MANUFACTURE—Manufacture of Steel. William R. Walker, New York, N. Y. (U. S. No. 1,035,280, Aug. 13, 1912.)

REGENERATIVE FURNACES—Reversing-Valve for Regenerative Furnaces. Hugo Gille, Dusseldorf, Germany, assignor to Façoneisenwalzwerk L Mannstaedt & Cie., Aktiengesellschaft, Kalk, near Cologne, Germany. (U. S. No. 1,033,577; July 23, 1912.)

SHERARDIZING FURNACE. John Riddell, Schenectady, N. Y., assignor to General Electric Co. (U. S. No. 1,034,930; Aug. 6, 1912.)

SINTERING—Improvements Relating to the Sintering of Fine Ore Material. J. Gayley, New York. (Brit. No. 23,038 of 1911.)

LEAD, ZINC AND OTHER METALS

ALUMINUM ALLOYS—Improvements in and Relating to Aluminum Alloys. G. J. Coles, Boston, Mass. (Brit. No. 6583 of 1921.)

LEAD—Process for the Manufacture of Arsenate of Lead. Felix Kaufler, Vienna, Austria. (Brit. No. 10,017 of 1912.)

LEAD—Production of Lead Compounds. Louis S. Hughes, Chicago, Ill., assignor to Picher Lead Co., Joplin, Mo. (U. S. No. 1,033,405; July 23, 1912.)

MAGNESIUM—Process of Manufacturing Magnesium Carbonate. Frank S. Young, Newark, N. J. (U. S. No. 1,034,330; July 30, 1912.)

NICKEL-COPPER MATTE—An Improved Method or Process of Treating Nickel-Copper Mattes. A. McKechnie, Birmingham, Eng. and F. G. Beasley, Smethwick, Eng. (Brit. No. 15,850 of 1911).

TIN—A Process for Reducing Stannic Acid. Zdenko Metzl, Rouen, France. (Brit. No. 27,606 of 1911.)

NONMETALLIC MINERALS

PETROLEUM—Oil-Well Apparatus. Carl. W. Davisson, Los Angeles, Cal. (U. S. No. 1,034,698; Aug. 6, 1912.)

PHOSPHATE ROCK—Art of Converting Phosphorites. Henry V. Dunham, Bainbridge, N. Y., assignor to Nacirema Chemical Co. (U. S. No. 1,034,090; July 30, 1912.)

POTASH—Process of Obtaining Potash from Felsdpar. James Millar Neil, Toronto, Ontario, Canada, assignor to Alexander M. Hay, Toronto, Canada. (U. S. No. 1,034,281; July 30, 1912.)

MINING—GENERAL

DREDGING—Improvements in Mounting and Operating Dredge Buckets. P. Mayer, Indianapolis, Ind. (Brit. No. 2233 of 1912.)

DREDGING-MACHINE. Issac Peterson, Oakland, Cal. (U. S. No. 1,034,501; Aug. 6, 1912.)

DRILL for Rock, Coal, and Other Material. Samuel S. Wyer, Columbus, Ohio, assignor, by mesne assignments, to Jeffrey Manufacturing Co. (U. S. No. 1,034,052; July 30, 1912.)

DRILL—Gasoline Rock Drill. Samuel S. Wyer, Columbus, Ohio, assignor by mesne assignments, to Jeffrey Manufacturing Co. (U. S. No. 1,034,053; July 30, 1912.)

DRILLING—A Mechanism for Intermittently Rotating the Drill Bit of Rock-Drilling Engines. J. G. Leyner, Denver, Colo. (Brit. No. 1344 of 1912.)

DRILLING—Improvements in and Relating to Rock-Drilling Engines. J. G. Leyner, Denver, Colo. (Brit. Nos. 1349, 1368 and 1383 of 1912.)

DRILLS—Front Cover for Rock Drills. Benjamin Cock, Camborne, England, assignor to Holman Brothers, Ltd., Camborne, England. (U. S. No. 1,035,083; Aug. 6, 1912.)

EXCAVATING BUCKET. James H. Murphy, St. Louis, Mo. (U. S. No. 1,033,822; July 30, 1912.)

EXCAVATING MACHINERY — Cast-Metal Dipper Front. Walter S. McKee, Glencoe, Ill., and Percival M. Vilas, Minneapolis, Minn., assignors to Edgar Allen American Manganese Steel Co., Augusta, Me. (U. S. No. 1,033,818; July 30, 1912.)

EXPLOSIVE—Safety Explosive. Norbert Ceipek, Vienna, Austria-Hungary. (U. S. No. 1,033,537; July 23, 1912.)

GALLERY FRAME FOR MINES. Wilhelm Binder, Altenessen, Germany. (U. S. No. 1,034,065; July 30, 1912.)

HOISTING—Valve Mechanism for Hoisting Engines. Sven T. Nelson, Chicago, Ill., assignor to Sullivan Machinery Co., Chicago, Ill. (U. S. Nos. 1,034,024 and 1,034,025; July 30, 1912.)

HOISTING BUCKETS—Dumping Appliance for Hoister Buckets. Asher Lambert, Newark, N. J. (U. S. No. 1,034,806; Aug. 6, 1912.)

SKIP. Lee Callahan, Los Angeles, Cal. (U. S. No. 1,033,670; July 23, 1912.)

TIMBER PRESERVATION—Process of Preserving Timber by Means of Phenolate Solutions. Friedrich Seidenschnur, Charlottenburg, Germany. (U. S. No. 1,034,652; Aug. 6, 1912.)

ORE DRESSING—GENERAL

BUDDLE—Automatic Discharging Ore Concentrating Revolving Buddle. E. C. Gray and E. S. King, Carn Brea, Eng. (Brit. No 21,415 of 1911.)

CLASSIFIER—Hydraulic Classifier. Lewis L. Beeken, Pittsburgh, Penn. (U. S. No. 1,035,145; Aug. 13, 1912.)

CONCENTRATION—Improvements in Ore Concentrating Tables. J. Rule, Camborne, Cornwall, Eng. (Brit. No. 14,081 of 1911.)

CONCENTRATOR. Ira Ferris Monell, Boulder, Colo. (U. S. No. 1,033,260; July 23, 1912.)

CONCENTRATOR—Endless-Belt Ore. Concentrator. Enos A. Wall, Salt Lake City, Utah. (U. S. No. 1,033,219; July 23, 1912.)

CRUSHER—Ore-Pulverizing Machine. Matthew Arnold, San Jose, Cal. (U. S. No. 1,035,136; Aug. 13, 1912.)

CRUSHING—Adjustable Crusher-Head for Rock-Crushers. Edward L. Pemberton, New Haven, Conn., assignor to Edgar Allen American Manganese Steel Co., Augusta, Me. (U. S. No. 1,035,041; Aug. 6, 1912.)

ORE CRUSHER. Milton F. Williams, St. Louis, Mo., assignor to Williams Patent Crusher & Pulverizer Co., St. Louis, Mo. (U. S. No. 1,034,552; Aug. 6, 1912.)

ORE-CRUSHER. Bruce W. Traylor, New York, N. Y., assignor to Traylor Engineering & Manufacturing Co. (U. S. No. 1,035,273; Aug. 13, 1912.)

ORE TREATMENT—Improvements in the Treatment of Ores. Murex Magnetic Co. and A. A. Lockwood, London, Eng. (Brit. No. 13,208 of 1911.)

SCREEN—Screening or Separating Machine. Thomas Leggett Sturtevant, Quincy, and Thomas Joseph Sturtevant, Wellesley, Mass., assignors to Sturtevant Mill Co. (U. S. No. 1,035,262, Aug. 13, 1912.)

SCREENING DEVICE. Orrice Ray Smith, Kellogg, Ida.; assignor of one-half to John Francis Carson, Kellogg, Ida.(U. S. No. 1,033,628; July 23, 1912.)

METALLURGY—GENERAL

ALKALI METALS—Manufacture of Alkali Metals. Heinrich Specketer and Wilhelm Hofmann, Griesheim-on-the-Main, Germany, assignors to Chemische Fabrik Griesheim-Elektron, Frankfort-on-the-Main, Germany. (U. S. No. 1,034,320; July 30, 1912.)

CONVERTER for Metal. Alexander Zenzes, Berlin, Germany, assignor to Zenzes Converter Company, Chicago, Ill. (U. S. No. 1,035,295, Aug. 13, 1912.)

ELECTRIC SMELTING—Improvements in or Relating to the Production of Metals from Their Ores. J. Harden and Electric Furnaces and Smelters, Ltd., London, Eng. (Brit. No. 15,824 of 1911.)

ELECTRIC SMELTING FURNACE. Charles A. Weeks, Philadelphia, Penn. (U. S. No. 1,034,747; Aug. 6, 1912.)

EXTRACTION—Improvements in the Extraction of Metals from Their Ores. H. M. Leslie, Glasgow, Scotland. (Brit. No. 28,235 of 1911.)

FURNACES—Improvements in Rotary Drum Furnaces. P. Pfeifer, Berlin, Germany. (Brit. No. 5867 of 1912.)

ORE REDUCTION—Method of Producing Refined Metals and Alloys. Albert E. Greene, Pueblo, Colo., assignor to American Electric Smelting and Engineering Co., St. Louis, Mo. (U. S. Nos. 1,034,784 1,034,785, and 1,034,787; Aug. 6, 1912.)

ORE REDUCTION—Process of Extracting and Refining Metals and Ores. Albert E. Greene, Chicago, Ill., assignor to American Electric Smelting and Engineering Co., St. Louis, Mo. (U. S. No. 1,034,788; Aug. 6, 1912.)

ROASTING—Improvements in or Relating to Mechanical Ore-Roasting Furnaces. John Harris, Sheffield, Eng. (Brit. Nos. 17,847 and 16,583 of 1911.)

ROASTING FURNACE — Mechanical Ore-Roasting Furnace. John Harris, Sheffield, England. (U. S. No. 1,035,186; Aug. 13, 1912.)

SCRAP—Machine for Compressing Sheet-Metal Scraps. John Dunn, Streator, Ill., assignor to Vulcan Detinning Company, New York, N. Y. (U. S. No. 1,033,089; July 23, 1912.)

SMELTING—Method of Operating Metallurgical Furnaces. George Hillard Benjamin, New York, N. Y. (U. S. No. 1,033,777; July 30, 1912.)

SMELTING FURNACE. Wallace H. Dow, Piedmont, Cal. (U. S. No. 1,032,745; July 16, 1912.)

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

H. C. Hoover is in New York.

Oscar Lachmund is in California on mine-examination work.

Frank H. Probert has returned from Europe and proceeded to California.

A. C. Perkins is in the Straits Settlements, installing dredging machinery.

W. E. Corey has returned to New York from a stay of several months in Europe.

Charles Kirchhoff has returned to New York after spending six months in Europe.

H. M. Crosman is now at the Tiro General mine, Charcas, San Luis Potosi, Mexico.

H. H. Johnson, of Johnson & Hoffman, has left London for British Columbia, on professional work.

A. B. Hermann, of Chicago, has been examining gold properties in the Manitou Lake district, Ontario.

George W. Maynard has gone to Arizonza to make an engineering examination in the Harqua-Hala district.

Sydney H. Ball has returned to New York, after having been in the northern Urals for two months on professional work.

William F. Ward, of Denver, has returned from Colombia, South America, where he has been examining placer ground.

A. E. Spriggs, of the Guatemala Mining & Development Co., which has a blanket-mineral concession in Guatemala, is in New York.

C. M. Derby, superintendent of the Natomas Consolidated, recently made a visit to Oregon on professional business for the company.

Minor C. Keith, president of the Abangarez Gold Fields of Costa Rica, arrived in New York, Aug. 22, after an extended visit to Central America.

Prof. Wilhelm Palmaer, of the Royal Institute of Technology, Stockholm, Sweden, is investigating the deposits of apatite in the Ottawa Valley, in Canada.

W. H. Storms, state mineralogist of California, has returned from Highgrade, the new mining camp in Modoc County. Mr. Storms will make an official report on this camp

E. Gybbon Spilsbury, of New York, consulting engineer of the Southwestern Steel Corporation, is on a visit of inspection to the company's iron-ore properties in Texas.

Newton Cleaveland, of San Francisco, consulting engineer of the Natomas Consolidated, recently spent a week with his family in mid-August at the company's cottage, at Natoma.

L. D. Davenport has been placed in charge of the engineering department of the Oliver Iron Mining Co., at Mesaba, Minn., where that company is about to open up three new properties.

R. S. Botsford has gone from the Bogolovsk Estate to the Pavda Estate, in Russia. His present address is Kyshtim, Nicolaevo Pavdinsk Estate, Vyia Station, Bogoslovsk, R. T., Province of Perm, Russia.

Eugene Hawkins, acting superintendent of the San Francisco mint, assumed the duties of superintendent, upon the death of Edward Sweeny, Aug. 17. Judge Sweeny's successor has not yet been appointed.

W. Gillette Scott has returned to Bishop, Inyo County, Calif., after a long absence in the interest of good-roads building and the state highway, for which the California Legislature appropriated $18,000,000 in all.

J. M. Hill, of the U. S. Geological Survey, has completed his reconnaisance of Highgrade district in Modoc County, Calif., and left there, Aug. 15, for Reno, Nev., where he was to receive instructions from Washington.

A. L. Dickerman, recently appointed consulting engineer of the Mayflower and Old Colony properties, has taken up his temporary residence at Houghton, Mich., and is making a geological survey of the mines in connection with their further development.

Isaac M. Scott, for some years president of LaBelle Iron Works, Steubenville, Ohio, will resign in the near future to become president and active in the management of the recently organized Wheeling Sheet & Tinplate Co., which will build a tinplate plant near Wheeling.

OBITUARY

Oliver B. Mitchell died at Flushing, N. Y., Aug. 22, aged 48 years. He was born in England and came to this country when a young man, settling in New York. Later he went to Florida, and was for a number of years engaged in phosphate mining.

Walter Balfour Harrub died at Oakland, Calif., Aug. 16, of paralysis. He was 81 years old, and was born in Plympton, Mass., in 1830. He went to California on the ship "Pleiades," sailing from New Bedford, Feb. 19, 1849. He engaged in mining and other pursuits, and since 1874 has made his home in Oakland.

Edward Sweeny, superintendent of the U. S. mint at San Francisco, died of heart trouble at San Francisco, Aug. 17. He was born at Fall River, Mass., in 1853. He went with his parents to California at the age of six years. The family home, then and for many years, was in Redding, Shasta County. Mr. Sweeny was for eight years district attorney of Shasta County, and for 12 years superior judge. He was appointed superintendent of the mint on Sept. 19, 1907. The burial was at Redding.

Charles Camden died at Oakland, Calif., on Aug. 11. He was past 95 years old, and was born in England. He went to Shasta County, Calif., in 1850, and was married in 1852 to Miss Philena Tower, a member of the family which gave the name to the well known Tower House, between Redding and French Gulch. Camden was one of the owners of the Iron Mountain copper mine, which was purchased and operated by the Mountain Copper Co. He was a heavy stockholder in the Spring Valley Water Co., of San Francisco. He remained a subject of England until 1864, when he became a citizen of the United States because of his purpose to vote for Abraham Lincoln.

Societies and Technical Schools

American Chemical Society—Charles L. Parsons, secretary, removes from Durham, N. H., to Washington on Sept. 1; and the main office of the American Chemical Society will be in that city after the date mentioned, with address as Box 505, Washington, D. C. This is in preparation for the International Congress.

Institution of Mining Engineers—The twenty-third annual general meeting will be held in Birmingham, England, on Sept. 11, 1912. The following papers will be read: "Recent Legislation in Regard to Land and Mines," by Alexander Smith. "An Account of a Series of Explosions in the Bellorie Mine, Alberta, Canada," by John T. Stirling and John Cadman. There will be excursions on Sept. 12 and 13 to neighboring points of interest.

American Electrochemical Society—The twenty-second general meeting of this society will be held, Sept. 7, 9 and 10, 1912, in connection with the eighth international congress of applied chemistry, and the American Institute of Mining Engineers. The following papers promise to be of interest to metallurgists: F. A. J. Fitzgerald, Heat Losses in Furnaces; C. H. Von Bauer, Electrolytic Induction and Resistance Furnaces; P. Heroult, Recent Developments of the Electric Steel Furnace; A. E. Greene, Electric Heating and the Removal of Phosphorus from Pig Iron; R. Amberg, the Function of Slag in Electric Steel Refining; F. T. Snyder, Electric Smelting of Zinc Ore; J. O. Handy, Extraction of Copper from Sulphide Ores by Roasting, Leaching and Deposition; L. Addicks, Cathode Impurities in Copper Refining and their Sources; R. C. Wells, Mineral Electrodes; O. P. Watts, Electrolytic Nickel Solutions; Hofman and Waryukoff, Decomposition of Metallic Sulphates at Elevated Temperatures in a Current of Dry Air; N. S. MacCollum, A Novelty in Openhearth Practice; Ralph H. Sweetser, Blowing In Blast Furnaces; W. N. Lacey, Electrolytic Refining of Silver-Bismuth Alloys.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Aug. 21—The decision recently handed down by the Supreme Court of California reversing the Superior Court of Nevada County in the case of the Champion Gold Mining Co., *vs* the Champion Mines Co., giving to the appellant the right to insist upon the purchase of the mines at the contract price of $347,000, is not likely to disturb the present operations of the North Star Mines Co. which is developing the property under a purchase bond. Under the decision of the Supreme Court an injunction might lie against the owner of the mines and the work of development be delayed or terminated. The attorneys for the appellant are reported to have advised their client against such course, as the continued operation of the mines will benefit rather than work a hardship on the ultimate successful litigant, besides being a large benefit in the matter of the employment of men and disbursing of earnings in Nevada City and Grass Valley. Pending the consummation of the negotiations between the parties to the suit the owner of the property demanded that the purchaser pay the second installment of the 1909 taxes, $1600, in addition to the purchase price. This was refused and the owner brought suit to recover possession of the mines. The lower court instructed that a verdict be rendered in favor of the plaintiff, the Champion Mines Co. The defendant appealed to the Supreme Court, which held that the contract for purchase provided for a clear title to the mines, and that as the second installment of 1909 taxes had developed into a lien upon the property the appellee could not give a clear title until the tax installment was paid. In the meantime the owner of the mines entered into a bond with the North Star Mines Co. for the development, and an option of purchase provided the development should warrant the price, which is not definitely known. A large amount of development and new equipment have been undertaken by the North Star; and among mining men who should know there is no doubt of the purpose of the North Star owners to purchase the mines, provided the present litigation does not interfere with the progress of development. In the trial in the Superior Court the Champion Mines Co., plaintiff-owner, was required to present very little evidence, so that the full merit of the case was not divulged at trial. It is reported that this company, now that the question of the tax installment is disposed of by the Supreme Court will, upon retrial of the case in the lower court, adduce substantial evidence in support of the demand for recovery of full possession of the property. The interest of the district lies in the continuous operation of the mines and the ultimate purchase by the North Star, regardless of the outcome of the litigation. The mines are extensive and valuable and require large capital and scientific operation to make them profitable. The North Star is competent to operate the Champion profitably as few other owners could, because of its situation with relation to the North Star mines, and because of the intimate, practical knowledge of the company in this district.

Butte

Aug. 20—Patrick Clark, president of the Bullwhacker Mining Co., who recently arrived here from Spokane, accompanied by an engineer, has announced that extensive development of the property, which has been idle for several years, has been decided upon. In the mine there is a vein of low-grade ore, principally carbonate of copper, with which is associated little or no gold or silver. In the past ore has been mined through a shaft and conveyed by wagon to the smeltery, but it has been decided to change the method of mining to a steam-shovel system, as the ore is found within a few feet of the surface. Many tests have been made on the ore. It has been found to be an excellent leaching ore, and the company has planned to install a 5-ton leaching plant at once, which, if it proves practical, will be replaced by a larger one. Much ore has been blocked out in the property, but owing to the expense of hauling, and the comparatively small percentage of copper, it has not proved profitable.

Salt Lake City

Aug. 22—The prevailing sentiment of Utah mine owners and operators in regard to forming an independent organization for the protection and encouragement of the mining industry in this region, or of coöperating with the American Mining Congress to this end, is in favor of an independent organization. This is shown by answers received to cards and letters sent to mining men by a special committee, asking their opinion. It is reported that Bingham mine owners and operators have already pledged financial aid and moral support to such an organization.

Replies have been received from Utah's representatives in Congress, concerning the resolution adopted by the Utah mine owners and operators at the meeting of Aug. 2, protesting against the decision of the Department of the Interior in regard to the East Tintic application for patent. Senators Smoot and Sutherland and Representative Howell state they will take the matter up with the Secretary of the Interior, and urge a reconsideration of the case with a view of obtaining a more liberal construction of the mining laws.

The new legislative appropriation bill, making no provision for the United States assay office at Salt Lake City, Utah; Boise, Idaho; Helena, Mont.; Deadwood, S. D.; Charlotte, N. C.; and the Carson City mint passed the House Aug. 17, but was amended by the Senate, Aug. 19, so as to provide for the continuance of the assay offices at Salt Lake City, Boise and other Western cities. The appropriation for the Salt Lake office amounts to $15,400. The action of the House was based on the recommendation of the Secretary of the Treasury, advocating the abolishment of government assay offices, as unprofitable investments. The amendment by the Senate was based on the grounds that the offices were not founded as investments, but as conveniences to miners and others. The Senate committee on appropriations has restored the appropriations to the bill, and the Senate has voted to retain them. Final action has not been taken.

A number of improvements and additions are being made at the Arthur mill of the Utah Copper Co., at Garfield. The twelfth section of the remodeled mill was put into commission about the middle of July. The thirteenth unit is about half finished. The re-treatment plant for washing concentrates has been overhauled, and was started Aug. 9. The new concrete concentrate bins are nearly finished, and a pendulum sampler (two-story tower) to sample the tails has been built and is practically ready for operation. There is a new tail race from this to convey the tailings several hundred feet out to the dam. More water has been necessary with the starting of the additional units in the last few months and has been provided for by a new pipe line from the Magna pumping plant. This has been in operation a short time. Arrangements have also been made to pump water back to the mill, so that it can be re-used.

The double track of the Bingham & Garfield R.R. between the Magna and the Arthur mills has been completed. This will greatly facilitates the handling of the ore, etc. A new ball park has been built at Garfield for the employees of the Utah Copper mills and the Garfield smeltery.

Suit was filed Aug. 3, 1912, in the United States district court by the Silver King Coalition Mines Co. against the Keystone Mining Co., in which the plaintiff seeks to quiet title to rights in the Red Fox, U. J. Wenner and Bruser patented lode claims at Park City, to which the defendant is stated to claim title. The suit is brought on the basis of apex.

Negaunee, Mich.

Aug. 24—The Cascade Range is to have a new mine just southeast of the village of Palmer, where the Longyear company has been drilling for several years. The corporation is known as the Cascade Mining Co., and is controlled by Minneapolis men, including the Longyear interests. O. B. Warren, of Hibbing, Minn., will be general manager; Capt. Thomas Nicholls, formerly with Pickands, Mather & Co., on the Mesabi range, will be mine superintendent; H. J. Wessinger, of Duluth, who until recently was chief mechanical engineer of the Oliver Iron Mining Co., will have charge of the installation of machinery. A four-compartment shaft will be sunk 750 ft. and lined with steel sets. A steel headframe will be erected, also modern mine buildings and 25 dwelling houses. The ore to be produced will be soft hematite of good grade. The owner of the fee is the Pittsburgh & Lake Superior Iron Co., of which Clark Kirkpatrick, of Escanaba, is president and which owns a large acreage on the Cascade range. A 5-drill, Ingersoll-Rand air compressor has been purchased for sinking purposes; the sinking of the shaft will probably take more than a year.

On the eastern end of the Cascade range, the Heidelbach interests of New York, who own 360 acres, have been diamond-drilling for nearly a year. Considerable interest has been manifested in the work as mining men of the district have long held a theory that the Cascade range continues across the eastern boundary of the Heidelbach land and connects with the Swanzy range.

Houghton, Mich.

Aug. 23—Mention has been made in the JOURNAL of the scarcity of labor in the copper country. Conditions have not been exaggerated and are particularly pertinent as regards trammers. Good men for underground work are at a premium, but trammers are especially noticeable by their absence. The Isle Royale company is said to be contemplating the importation of 200 laborers from New England for tramming purposes. The Victoria mine, at the south end of the range, in Ontonagon County, is reported to be erecting 12 houses as an inducement to retain good, sober, married men as trammers. One must go back many years to find a parallel to this situation in this district.

Kingman, Ariz.

Aug. 23—A heavy storm which assumed the proportions of a cloudburst in the Hualapai Mountains did considerable damage to some of the roads leading from Kingman to the surrounding camps, and for a few days transportation was seriously impeded. The Lovin & Withers company, which has a number of outfits freighting to Gold Road and Oatman lost two heavy wagons; the men and teams barely reaching a place of safety in time to escape the flood.

M. W. Musgrove has recently returned from New York. His Eastern trip was for the purpose of interesting certain men in a project for damming the Colorado River near the place where it emerges from the Grand Cañon. He was authorized to procure the necessary engineer's report and last week accompanied Frank Culbertson to Grass Springs and Pierce's Ferry, to assist in making an examination. If the plan is carried out it will provide power for the mines of Mohave County at a lower cost of production than is at present possible.

Phoenix, Ariz.

Aug. 23—The bill generally known as the miners' lien law has been referred by petition to the people for a vote at the next general election. It was passed by the first state legislature, which was composed almost entirely of inexperienced men. The lien law passed the lower house unanimously, this house being dominated by the labor men, and the few who were not under this influence, were ignorant of the needs of the mining industry. When the bill reached the upper house, an attempt was made by the far-seeing members to amend the bill, so as to protect the prospector and the owner of the small mine, especially the small rich mine, that is peculiarly fitted for leasing. The principal objections to the law, which states that any miner working on a mining claim, and not receiving his pay, shall have a lien on the claim for the amount of his unpaid wages, are that it is unfair to the owner of a leased claim, and really does not protect the laborer, and will work to the disadvantage of all honest men whether miners or prospectors. In a long list of payrolls defaulted in Arizona in the last ten years, only one or two cases would have come under the provisions of such a bill so as to protect the miners; in most cases because the property was already subject to the lien of taxes or a prior mortgage, which must always remain a first lien against miners and all other subsequent incumbrances. Such a law will tend to make owners wary of leasing or bonding their claims, because there is a certain amount of danger. If a bond to pay the miners is exacted from the lessee, there is always trouble to get a satisfactory bond, where the parties have no mutual acquaintances, and the lessor will be apt to scrutinize the bond too closely. The lessee, on the other hand, after an experience or two, is sure to become discouraged, and drop out of the leasing class. And all this where there is scrupulous honesty on both sides. One of the most frequent results will probably be, that a lessee or bondee will be tempted to continue a losing venture beyond his means, because he knows that, whatever happens, his men will be paid; and men, thinking their wages safe by reason of the lien, will work along after default, and it is well known that labor under such conditions, is worthless. Another disagreeable feature is the grave doubt of the constitutionality of the law; a similar law in Wyoming has been set aside by the courts. However this may be, it is to hoped that the people will vote the law down, at least, until it has been amended to cure its obvious defects, and if such a law must be passed to curb dishonesty, that it be made to apply to all kinds of business and all kinds of debts; in other words, make it universal and fair—a square deal for all.

Toronto

Aug. 23—Samuel Price, mining commissioner for the province, has been instructed to make an investigation of the condition of underground labor in the mines of Ontario. His appointment grew out of an attempt to pass, during the last session of the provincial legislature, a bill for an eight-hour day for underground mines. The mine owners contended that mining in Ontario was in an undeveloped state and that while the bill might be proper and applicable to deep mines, that condition as a whole throughout the province rendered it impracticable. It was also contended that on account of the unskilled labor employed to a large degree, the time was not opportune for its enactment. Mine owners in the eastern part of the province particularly objected to the passage of the bill. They stated that there is no demand for it among the men. In view of these contentions the government felt that great care should be exercised before passing legislation of this kind, and that all possible information as to its effect should be obtained. Mr. Price will hold meetings in the different mining centers, and will give everyone an opportunity to present his side of the case. The effect of the eight-hour law where in force will be studied, and a report will be presented at the next session of the legislature.

The Mining News

The Current History of Mining

Arizona

Gila County

Southwestern Miami—Churn-drill hole No. 8 on this company's claims, which lie to the southwest of, and adjoin the Live Oak mine, is 860-ft. deep in chalcocite-bearing schist. Chalcocite first appeared at a depth of 720 ft. in small quantities and is now reported to be in commercial quantity. Hole No. 7 is 805 ft. deep in mineralized schist, the sludge from drilling being heavily iron-stained. Hole No. 6 is 825 ft. deep in schist.

South Live Oak—Churn-drill hole No. 3 is 125 ft. deep in silicified schist carrying copper as silicate and oxide. The hole is on a hill near Needle Mountain, at the northern end of the property, nearly a mile from the first two holes. Water for drilling is pumped 7000 ft. through a vertical distance of 700 feet.

Old Dominion—For protection against the probable results of the recently enacted miner's lien law, this company has posted a notice requiring all lessees to give a bond of $5000, which will work a hardship in many cases.

Inspiration Consolidated—The construction of the spur from the Arizona Eastern R.R. to this mine has been started with a force of 50 men, which is being increased as rapidly as possible.

Miami—The two chilean mills in the first unit of the concentrator are being replaced with three 8-ft. Hardinge pebble mills. The fourth and sixth units are already equipped with the latter type of fine-grinding machinery and Hardinge mills will eventually replace chileans in all six units.

Santa Cruz County

Sonora—This mine, owned by the Protopsalte brothers, of Nogales, is being worked. Good silver ore is being taken out, and packed on burros to the railroad at Nogales.

Red Cone—This mine was formerly known as the Four Metals; the upper tunnel is 425 ft. long, and has penetrated copper ore. The lower, which is to be the main working tunnel, will cut the ore about 200 ft. lower; the face is now 850 ft. from the portal. It is thought that by driving a few feet more it will cut the lode.

Crescent—The tunnel on this property is now a little more than 600 ft. long.

Duquesne—Shipments are being made at the rate of six tons per day, and as soon as teams can be found, will be increased. The work is being done by Judge Trickey.

French—This old-timer has been bought by William A. Clark, who intends to sink a 500-ft. shaft, but work has not yet commenced. The mine has been a profitable producer.

Cunningham—The first payment has been made on this property.

Morning Glory—This property, owned by Christopher Wilson, of Patagonia, is shipping low-grade copper ore which is desired by the smelter on account of its iron. At present the ore is going to the Pioneer smeltery, at Tucson.

Wieland—This camp is shipping copper-silver ore to El Paso.

Augustus—This mine, generally known as the Pinal, has been sold by Yarick & McDonald to the Arizona-Pacific Copper Co., of which Col. O. P. Posey is president. T. J. Cunningham and H. E. Stevens are at present on the property preparing a report for the English contingent represented in the purchase.

Gray—This group, lying next to the R.R.R., has been leased to Hogan & McKutcheon, and work has begun.

R.R.R.—This mine, recently sold to N. L. Amster and associates, has shipped about 60 cars of ore since the purchase. It is proposed to increase these shipments as rapidly as possible.

California

Calaveras County

Jones—The 40-stamp mill and other buildings were burned Aug. 10. The fire originated in dry grass south of the mine. The mine and the mill had been idle for about five years. The fire spread to the Whittle mine, damaging timbering in the shaft and destroying the headframe. The buildings at the Meeker, Tulloch and Santa Anna were saved.

Missouri—This group of mines, including the Dolly Varden, Jack Peterson and Eltringham, an area of about 35 acres, has been sold to R. W. Stuck, of San Francisco.

Eldorado County

Big Buzzard—There is a 5-stamp mill at this mine, on Negro Hill, owned by Darrington brothers, F. N. Major and Joe Foster.

Humboldt County

Horse Mountain Copper Co.—Adjoining claims have been taken over by the company, the sellers taking stock as part payment.

Gem—This placer mine has ample water. Development work has been in progress since spring.

Kern County

A deposit of magnesite has been located at Bissel, about 11 miles east of Mojave station, on the Santa Fé, by B. M. Denison, of Tehachapi.

Antelope Valley Gold Mining Co.—A 100-ton Beer roller quartz-mill is being installed to work the old tailings dump.

Consolidated Mines Co.—The shaft is down 250 ft. and drifts are being driven at this and the 200-ft. level. An electric pump may be installed to remove the water from the Kenyon Wedge shaft adjoining, which is 550 ft. deep. The Galveston and Twin Brothers claims, which are part of the company's holdings, will be worked by lease by Ashford brothers. N. M. Kirkpatrick, of Los Angeles, superintendent.

Placer Gold Mining Co.—The new concentrator is in operation at this property, in the Stringer district. J. R. Metcalf, of Los Angeles, secretary.

Nevada County

Gillespie—A 6-drill electric compressor is being installed at this mine, on the Champion contact. The shaft is 200 ft. deep and will be deepened 150 ft. Dan Mc. Gonigal, superintendent.

Union Hill—Tungsten ore of good quality is reported from this property, but has not yet been thoroughly developed.

Delhi—The first mile of the new 5¼-mile flume, to furnish power for operating the mine, is being completed, and it is expected that water will be flowing the entire length before snow falls. A dam has been built in the middle Yuba River, about seven miles above North Columbia. About 1400 hp. will be developed. Hamilton Eddy, of Nevada City, superintendent.

Plumas County

Crescent Hill—A 20-hp. gasoline engine and concentrator and other necessary machinery will be installed immediately. There is now a 20-hp. gasoline engine in use at the mine. W. E. Oddie, superintendent.

Moonlight—Will Boyden and A. D. McMillan have developed some good copper prospects here.

Colorado

Clear Creek County

Silver Plume Mining & Tunnel Co.—At the annual meeting of the stockholders, Aug. 13, the old officers were reëlected. The company is driving a crosscut tunnel and drifting therefrom on two veins. A narrow vein of rich ore was recently opened in one of the drifts. W. H. Stephens, manager.

Gem—The double-drum hoist is now being installed at the new shaft house.

Mattie—During July the main shaft was sunk 20 ft. This work is the beginning of a policy of systematic development outlined by men now in control of the reorganized Little Mattie M. M. & P. Co. It is the intention to sink the shaft and drive levels to prospect the ground immediately below some of the old orebodies in order to determine their extension.

Capital—The mill is being remodeled and improved. A railway spur is under construction to connect with the Colorado & Southern tracks. This work will be completed in about 30 days. Regular shipments of milling ore are being made to local concentrating mills.

Lake County—Leadville

An important strike is reported on the Columbine, situated on Sheep Mountain near Robinson in the Ten Mile district. A fairly wide vein of silver-lead ore is said to have been opened which gives high assays, and eight cars have been shipped to the smeltery. The strike was made on the Eureka claim in a drift from the shaft which is 220 ft. deep. John Irwin, resident manager.

Mt. Champion Mining Co.—Manager Smith states that the mill will be running in two weeks.

Louisville — Hanifen & Reynolds, lessees, are shipping 75 tons of zinc-sulphide ore per day. This comes from a level 400 ft. below the level of the Yak tunnel.

Dinero Tunnel—This property, on Sugar Loaf Mountain, is producing 250 tons monthly of good-grade ore.

San Juan District

Wild Boy—This property in Gold King basin is being developed under the management of W. M. Harrington. Some of the old workings have been cleaned out and retimbered, and are being advanced. A new level has been started above the present workings. The foundation for the new mill is completed, part of the machinery is on the ground and the plant will probably be in operation early in the autumn.

Little Dorrit—This group of properties in Bridal Veil basin is being reopened under the management of W. Z. Kinney, formerly of the Gold King mines at Gladstone, San Juan County. Men are now cleaning out old workings and placing the property in condition for further development. An air-compressor and drilling equipment will be installed. The main tunnel, which is now 1200 ft. long will be extended to cut the Lewis vein. The Lewis property adjoins the Little Dorrit on the north.

Morning Star—The Sunshine tunnel is being advanced to intersect the Magpie vein. Pipe lines have been extended and the water power is now sufficient for the operation of the air-compressor plant.

Teller County—Cripple Creek

Isabella—A rich strike has been made by lessees at the 768-ft. level.

United Gold Mines Co.—The output of the various properties owned and leased by this company for the month ended July 31, was 32 carloads of ore.

Moffat Estate—The various Cripple Creek properties owned by this estate are under the management of Philip Argall & Sons who are now leasing them. Clark and Godfrey have a lease on the Roxana main shaft and T. Hendry and A. McClurg also have leases on blocks 3, 4 and 5. A. L. Watson, of Cripple Creek, and Andrew Elliott, of Victor, have leases on the Venture mine. The Victor mine is operated by the Western Investment Co. and its sublessees.

Stratton's Independence—The output is now about 400 tons per day of low-grade ore with 40 sets of lessees and 23 men on company account.

C. K. & N.—The output from the Rapp vein by M. I. Rapp & Co., lessee, is 25 cars per month.

Jerry Johnson—This mine on Ironclad Hill, under lease to Frand Caley, is shipping about 40 tons per day.

Acacia—The output from the South Burns shaft by the Burns Mining Co., lessee, is 10 carloads per month of medium-grade ore.

Last Dollar—Last month a new cable was installed which will permit the hoisting of ore from the twelfth level. A. May, of Colorado Springs, is the lessee with seven sets of sublessees. The output will now be about 15 cars per month. Frank Saunders, is superintendent.

Idaho

Coeur d'Alene District

Marsh—This mine is shipping 100 tons of ore per day to the leased mill on Nine Mile Creek, the output having recently been increased from 60 tons. A new 12-drill Ingersoll-Rand compressor and a 150-hp. motor are to be installed immediately. The old plant, consisting of a 10-drill compressor and a 100-hp. motor was not sufficient for development and regular mining work. As soon as the new plant is installed drifting will be continued on both the east and west ends of the 450-ft. level, which is the lowest in the mine.

Ajax—The lower tunnel has crosscut the vein, and some good milling ore was found. It will take much drifting, however, to reach a place under the best surface showing. The entire vein has not yet been cut. As soon as this has been done, drifts will be driven both east and west.

Snowshoe—This company is still drifting east on its orebody. A crosscut has been run to the foot wall, showing a body of good-grade sulphide ore. The drift will be continued along the hanging wall and crosscuts will be run to the foot wall from time to time. All ore so far developed is of excellent milling grade.

Chicago—A report from Paragon states that good concentrating ore has been struck on the lower level at this property.

Terrible Edith—Two cars of ore, one of zinc and one of lead ore, were shipped recently from this mine. All the ore is hand picked, as the company has no concentrator. Both stoping and development work is being carried on, and owing to the lack of milling facilities a large amount of good concentrating ore is accumulating on the dump.

Michigan

Copper

Oneco—Sinking has been temporarily suspended at a depth of about 1200 ft. and activities are centered in drifting at the 11 and 12 levels. Some bunches of good stamping ore have been exposed in close proximity to the shaft. Results in the extension of the drifts will be watched with interest as the drilling work carried on about two years ago resulted in the cutting of some rich cores.

Norwich—Operations are to be resumed at this property which adjoins the Victoria, in Ontonagon County. This property was worked several years ago without revealing any ore of commercial grade, although much mass and heavy copper was taken out.

New Arcadian—A compressor has been started at this property and the steam drills will be superseded by air drills. The shaft is down about 75 ft. and is being sunk on an amygdaloid formation which outcrops at the place where sinking has been started and which lies between two other formations from which well mineralized cores were extracted during drilling operations.

St. Louis—This subsidiary company of the Calumet & Hecla is doing development work. Drifting is being done at the second and third levels. The shaft is down below the fourth level and drifting is to be started from that level at once.

Calumet & Hecla—This company is clearing a site for buildings at its smelting location on the shores of Torch Lake, at Hubbell, for the erection of an elec-

trolytic refinery. This plant will be about 250x150 ft. and in it the lower grades of mineral will be treated for silver. That product is now being treated at the company's Buffalo plant. This plant will be put in commission in 1913.

IRON

Maas—At this mine of the Cleveland-Cliffs Iron Co. underground operations which were suspended in December, 1910, have been resumed, and more men are being employed. Before the shutdown about 275 men were employed and the present force of 100 men will be gradually increased to this number as conditions warrant, two 8-hour shifts are now being worked. The mine was closed to permit the Foundation Co. to replace the wooden shaft with one of concrete, as that part of the shaft through the thick surface soil was badly out of line and so much water was coming in that it was feared that Teal Lake, near-by, was draining into the mine. Since the concreting was finished a year ago, the amount of water in the mine has been considerably reduced, but the underground operations were not resumed until recently, because of lack of demand for the ore. The mine is worked by the caving system and the shaft is 1100 ft. deep. S. R. Elliott, superintendent.

Richmond—At this open-pit mine on the Cascade Range two shifts are now being worked in place of one as formerly. By the end of the year, this mine will have shipped nearly 1,000,000 tons, practically all since 1899. The property consists of one 40-acre tract, the fee of which is owned by the Oliver Iron Mining Co., in common with other land comprising the middle portion of the Cascade Range. The lease of the M. A. Hanna company which operates the mine will run about five years longer.

Peninsula Power Co.—This Menominee Range power company has completed a concrete dam 600 ft. long and 42 ft. high on the Menominee River. The power house is nearly completed. A transmission line on four-post metal towers 40 ft. high, is being constructed to conduct current 30 miles to Iron River, where it will be sold to mining companies. It is expected that the water-power plant will be in operation by Oct. 1. The stockholders are Michigan and Wisconsin men.

Minnesota

CUYUNA RANGE

Virginia Mining Co.—In drifting from shaft No. 2 of the Barrows mine, a rich orebody was cut 30 ft. sooner than expected. Shaft No. 1 is down 80 ft. The pump is being taken out of shaft No. 2; what little water is in the shaft can easily be siphoned out. It is now thought that shipments from the Barrows mine will be made in September, and it will be the first shipper on the South section of the Cuyuna Range.

MESABI RANGE

Three shovels are loading ore at the Genoa pit, and the No. 2 stockpile at the Gilbert mine is being shipped. It is said that the stockpile at the Pettit mine has been sold, and also a large portion of the Schley stockpile.

The Winston-Deere contractors, stripping on the Great Northern property, recently applied to the local lighting company to furnish sufficient light to permit operation by day and night crews.

There was a decrease in the ore movement from the Mesabi Range recently, owing to the congestion in delivery of ore cars at the mines and in dispatching at the docks at Duluth.

Carlson—This company is redrilling some ground in the Buhl district for the Arthur Mining Co., and is also doing some development work on its own properties on the Cuyuna Range.

Crosby Exploration Co.—The company has begun exploring for iron ore on the Keating property within the city limits of Crosby. The property is to the south of the Thompson mine.

Missouri

JOPLIN DISTRICT

Wingfield—Many improvements are being made at this mine, north of the residence district of Webb City. Mule haulage is being installed and additional air lines are being laid.

Symmes Mill—This old mill at West Joplin has been taken over by Frank H. Danglade and associates. The mill now treats 200 tons per day and is to be remodeled to treat 350 tons; 70 acres of land have been leased and it is proposed to build two more mills as soon as the ground is developed.

General Lead & Zinc Co.—This company is building a mill at Gordon Hollow to treat ore from the old Sunshine Mine which is being reopened by prospectors.

Granby Mining & Smelting Co.—Nine churn drills are being operated, five in the Granby camp, two in an isolated region between Granby and Duenweg, two on leases already being mined, one at Oronogo and one at Chitwood.

Tanyard Hollow—A new concentrating plant of 150 tons capacity is being built on a lease of 26 acres. It is expected to be ready for operation in two or three weeks. A 650-ft. tramway is being constructed to connect the mill with a shaft in Gordon Hollow. The land has been drilled and ore found at a depth of 60 to 80 ft., one shaft being in ore at the mill and two others nearby.

Temagami—The sheet ground of this old mine in West Joplin, is to be worked after several months' idleness. The pumps have been started and the ground almost drained. Development will be conducted from a depth of 200 ft. Former operators have worked the upper ground where bodies of soft ore were encountered.

K. & W. Mining Co.—This company has completed the draining of the Mandarin workings on a 40-acre lease of the Riseling estate. Some ground breaking has already been done in some of the drifts, good-looking ore being revealed.

Montana

BUTTE DISTRICT

Tuolumne—This company has successfully negotiated with the Anaconda for treatment of its second-class ore at the Washoe smeltery, and is now shipping about 50 tons of first-class, and 250 tons of second-class ore daily. Second-class ore has never been shipped before while first-class ore has been shipped as fast as mined. Second-class ore, therefore, accumulated. Shaft sinking has been resumed and will be continued from the 1800-ft. to the 2000-ft. level.

Raven—The sinking of the shaft from the 1500-ft. to the 1700-ft. level has been completed, and a station is being cut on the bottom level. The company is planning to crosscut to the vein. If work on this level does not prove the existence of commercial bodies of ore, the prevailing opinion is that it will mean the final closing of the property. Mining, principally by lessees, is being done in a small way in the upper levels, and occasional shipments of ore are made.

DEER LODGE COUNTY

Butte & Georgetown M. & M. Co.—This company, owning placer ground in the Georgetown district, is carrying on extensive development work. A portion of the ground is being hydraulicked, and the first cleanup of the sluice boxes was recently made with satisfactory results. On the banks of Georgetown creek, which crosses the property, a shaft is being sunk to bedrock, to explore the old channels of the stream, of which three have been discovered, separated by hardpans of clay. When bedrock is reached drifts will be run to explore the width of the channel. Plans are being laid for the construction of a dredge this autumn. The work now being done is to demonstrate the feasibility of buying a modern dredge.

Georgetown Gold Mining Co.—At this mine 400 ft. of tunnel has been completed by Benson & Gabrielson, who have the work under contract, and it is probable that an immediate continuation will be ordered at a meeting of the directors to take place shortly. Charles Bostron, part owner and manager of the Ore Fino mine, is in charge of operations.

Baltic Combination—Work is progressing steadily at this mine in the Georgetown district. A Webb gas engine for hoisting has been purchased and will be installed at once.

Butte & Anaconda Consolidated Mining Co.—This company is operating a property on the edge of Georgetown townsite. Buildings are being erected, and supplies brought in for continuous development work. John Stanhall, of Anaconda, is managing operations.

Hidden Lake—The investigation of the property which was started some time ago by men holding an option, is still being carried on. The main vein has been traced by shallow cuts and shafts for 2000 ft., and gold discovered in most of the workings.

FERGUS COUNTY

Barnes-King—This company is preparing to open the Santiago mine in the Kendall district. This was a producing mine several years ago. The Barnes-King mill will be used to treat the ore.

War Eagle—Operations have been resumed at this mine at Maiden, and two carloads of ore have been shipped, one to Salt Lake City, the other to Kansas City.

JEFFERSON COUNTY

Boston & Corbin—Regular shipments of ore have have been made during the last two months from the property of this company in the Corbin district, and nearly all the expenses of the extensive development work being done there are being met from the proceeds. Although actual work has not yet been started on the new concentrator, the plans have been approved by the directors, and contracts are to be let shortly.

Sunlight—Preparations are being made to open this old mine near Whitehall, an inspection of the property having just been made. Plans call for the installation of new and improved machinery in the concentrator.

Nevada

CLARK COUNTY

Yellow Pine—The new concentrating machinery for the addition to the mill is now on the ground, and will be installed during the coming month. The electrification of the two pumping plants supplying the mill is now almost completed, and the change in power will be made about the first of the month. Orders have been placed for five additional 10-ton cars for service on the company's narrow-gage railroad.

Alice—A. J. Robbins, manager of this property, which adjoins the Yellow Pine on the south, states that lead-zinc carbonates have been found in the shaft at a depth of 350 ft. The ore also contains copper and silver. A carload has been shipped as a trial lot.

Bullion—Tursick & Munzeberg, lessees of this property, have two cars of high-grade lead-carbonate ore ready for shipment. Messrs. Yount and Fayle, of Goodsprings, have a bond on the property.

Ninety-nine—Shipments of copper ore from this property will be resumed at once. It is also rumored that the company will erect a sampling mill at Jean, which will handle custom ores, as well as its own product. J. B. Jenson, manager.

Clark County Lead & Zinc Co.—This company was recently organized and incorporated in Los Angeles, to effect a consolidation of several properties in the western portion of the district, with a view to erecting a concentrating mill to treat the lead and zinc ores from the various properties. A fair tonnage is blocked out in the mines.

COMSTOCK LODE

Union Consolidated—A change in the management was made recently at a special meeting of the directors. B. F. Shaw retired as president and director, and J. H. Goldman, of San Francisco, was named in his place on the board. John Landers was elected president and Whitman Symmes, mine manager, in place of C. E. Julihn. Mr. Symmes was also elected superintendent of the Union shaft. The company plans extensive exploration below the 2500-ft. level, and a new compressor to double present equipment, has been ordered jointly by the Union Consolidated, Mexican and Sierra Nevada companies.

Ward Shaft—The United Comstock Pumping Association, operating this shaft, has decided to discontinue deep pumping at this place for the present and devote its energies largely to the North End mines, through the C. & C. shaft. The Ward shaft will not be abandoned, and water will be held at the present level, just below the 2100 station, where there are three Scranton pumps. Further efforts to unwater the shafts to the 2475 level have been discontinued.

C. & C. Shaft—The new vertical centrifugal pump was lowered this week to the 2500-ft. level of the shaft, and is now being tested. Within a week, it is expected that this pump will be put into commission, raising the water from the sump to the 2310 station pump.

Consolidated Virginia—Plans are being considered relative to exploring the ground north and south from the shaft on the 2300-ft. level, which will be possible soon after the new pumps are doing regular service at the C. & C. shaft. A station is also to be cut out at the 2400-ft. level, and the territory adjacent thereto prospected for the first time.

Ophir—A shipment of 45 tons of concentrates was made last week to the Selby smeltery, it being the clean-up from a run of 1500 tons of second-class ore at the Kinkead mill. The shipment was valued at $35,000. The southwest drift on the 2500-ft. level has cut the vein again, porphyry and quartz of low assay being found in the face.

NYE COUNTY

Shipments in tons from Tonopah mines to date and for the week ended Aug. 15, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,500	110,369
Tonopah Belmont	3,225	72,166
Montana-Tonopah	1,029	33,892
Tonopah Extension	1,060	32,513
West End	825	23,814
Midway	.....	380
MacNamara	462	11,397
North Star	.....	130
Mizpah Extension	.....	40
Jim Butler	100	100
Totals	10,201	284,801
Estimated value	$255,025	.....

WHITE PINE COUNTY

Giroux—Present production is about 900 tons per day, all of which comes from the underground workings of the Morris and Bunker Hill shafts. The new bins at the Morris will have a capacity of 1600 tons of ore.

New Mexico

A rumor has gained credit in Albuquerque, that Phelps, Dodge & Co. is negotiating with the Santa Fé R.R. for that part of the road extending from Rincon to Silver City, with a branch from Whitewater to Santa Rita and Fierro. That line does not contribute much to the Santa Fé system, but would be valuable to the Phelps-Dodge company and to its railroad system, because of its large holding of valuable mining property at Fierro and in the Burro Mountains, at Tyrone and Leopold. Phelps, Dodge & Co. state that there is absolutely no ground for the rumor.

GRANT COUNTY

Savanna Copper Co.—The Pacific No. 2 mine of this company, in the old gold-mining camp of Pinos Altos, is being operated under lease to Frank C. Bell and A. L. Wright. A new shaft is being sunk to a depth of 100 ft., in virgin ground. The old tunnel has been cleared out, and the work of stoping is now in progress. A winze is being sunk to connect with the tunnel for ventilation. Pay ore in commercial quantities is being taken from the shaft, winze and tunnel, and shipments are being made at the rate of one car per week to the El Paso smeltery.

Mangas Development Co.—It is understood that arrangements are practically completed for the resumption of work by this company in the Burro Mountains.

SOCORRO COUNTY

Tri-Bullion Smelting & Development Co.—High-grade copper ore, containing gold and siver, has been found on the 300-ft. level of the Nit mine. The find was made 500 ft. east of the shaft and is of interest because it is the first large vein of commercial copper ore that has been found in the vicinity of Kelly.

Utah

Juab County

Tintic shipments for the week ended Aug. 16 amounted to 205 cars.

Eagle & Blue Bell—Raising is now being done from the 1350-ft. level to connect with the upper ores, and when this is completed will facilitate the handling of both ore and waste through this outlet. A contract for an ore house large enough to hold 300 tons has been given to Alexander McDonald and work will be started at once.

Uncle Sam—The special stockholders' meeting called for Aug. 7 was postponed until Aug. 21, owing to lack of a quorum. It is proposed to increase the stock from 500,000 shares to 750,000, to be applied to the acquisition of the Richmond-Anaconda property.

Grand Central—A dividend of 5c. per share, amounting to $30,000, has been declared, payable Aug. 25. The last dividend was paid in December, 1911, and brought the total to $1.410,000 paid up to that time. Ore has been found on the 2300 level. This carries gold and silver, but no copper, and as far as opened is not of shipping grade. Drifting is in progress on this level to get under orebodies opened on the level above. The 2300 is one of the deepest levels in the district.

Utah Ore Sampling—The Silver City plant of this company is now being operated.

May Day—Shipments of zinc ore were started Aug. 20.

Iron Blossom—The cave opened recently has not been explored, but enough work has been done to show that it contains some ore. A drift is being driven on a lower level to get under this ground.

Piute County

Bully Boy & Webster—The new 100-ton mill, in Bullion Cañon, should be running at normal capacity within the next few weeks.

Salt Lake County

Montana-Bingham—The tunnel of this company recently penetrated soft ground with a large increase in the flow of water. Timbering has been necessary. The face shows mineralization, and is thought to be in the neighborhood of the Quinn fissure.

Columbus Extension—The vein, recently cut, shows mineralization, chiefly iron, at some places. It is being drifted on in search of oreshoots.

Peruvian—The control of this property, at Alta, has recently changed hands, being taken by Messrs. Ryan and Thompson, of Salt Lake City, from the Clay estate. The property adjoins the South Hecla on the southwest, and extends over Bald Mountain on to the American Fork slope. About 400 ft. of development has been done.

Columbus Consolidated—Several cars of concentrates will be shipped this month.

South Hecla—The winze in the west drift on the Dwyer level is down 81 ft., and is stated to be in ore, carrying copper, silver and gold. The south drift on the Wedge fissure is being continued, and is still in mineralized ground.

Summit County

Park City shipments for the week ended Aug. 17 amounted to 3,610,600 pounds.

New York Bonanza—A shipment of 33 tons of ore from this property is on the way to market.

Daly—A small force has been put at work and this will probably be increased. A station was recently cut between the Daly and the Daly West mines on the 2100-ft. level. There is a block of ground in this neighborhood upon which little prospecting or development has been done.

Silver King Coalition—It is reported that work has been started in driving a new adit from Nigger Hollow to tap the lower levels of this property.

Tooele County

Shipments are being made by some of the Dry Cañon mines.

Lion Hill Consolidated—Shipments from this property have been started over the new 9½-mile branch railroad from Ophir to St. John; 18 men are at work. Tests on low-grade ore are being made with a view to possible milling operations. Development is being done in the Chloride Point tunnel and incline. A shipment of 50 tons was made recently from a new orebody encountered in this ground. Another shipment is nearly ready for the market. Lower-grade ore than formerly can now be marketed, on account of the better shipping facilities, as compared to the wagon haul formerly necessary.

Cliff—Steady shipments are being made from this property, which is much benefited by the new railroad.

Utah County

Utah Black Marble—This company has recently secured a number of claims covering marble deposits in Spanish Fork Cañon.

Washington

The American Smelting & Refining Co. is making preparations for improvements at the plant, at Tacoma.

Blue Jim—Work is to be resumed at this mine, near Metaline, Stevens County. A power plant will probably be installed.

Phoenix Gold & Copper Co.—This company is considering the installation of a compressor plant and other machinery on its property, near Curlew, Ferry County. George Ilse, of Spokane, president.

North Washington Power & Reduction Co.—This company will soon begin work on the transmission line from Republic to Grand Forks, for supplying the mines in that vicinity with electric power.

Imperial—Among other improvements being made at this mine, near Chewelah, Stevens County, hoisting machinery is being installed.

Consolidated Gold Mines & Reduction Co.—This company has been organized and has taken over the property of the Golden Eagle company, near Blewett, Chelan County. The plant will be overhauled, and men placed at work at once. F. S. Earnest in charge.

Snohomish County

Del Campo—A compressor plant and other machinery are being installed at this mine, in the Monte Cristo district.

Florence Rae—A paystreak of chalcopyrite was recently uncovered on this property, near Everett. Nicholas Rudebeck, manager.

Eclipse—The new compressor and machine drills recently installed at this mine, near Silverton, are now in operation. The ore is gray copper rich in silver.

Wisconsin

Platteville District

The Red Jacket mining property and fee to 157 acres has been purchased by the Mineral Point Zinc Co. The tract embraces old mining ground that has produced large quantities of smithsonite. The mine was formly operated by the Madison Mining & Development Co. and is four miles north of Montfort.

New Mexico Mining Co.—Lease to the Tracy farm has been obtained and an option taken on the Old Mexico mining plant by a Milwaukee company incorporated under the above title.

Galena Iron Works Co.—This company is moving the Kohinoor mill to the Hodge mine.

Wisconsin Zinc Co.—This company is installing 1000 ft of Lawson aerial tramway at the Winskell mine near Shullsburg.

Trego—Since resuming work a few weeks ago, a big sheet of zinc ore has been discovered in the floor of the main drift. This mine was previously operated by the Monarch Mining Co. The lease is now held by the Wisconsin Separating Company.

Belmont—Prospecting is again underway at this property, which lies just northeast of the Empire.

Harms—A local company has taken over the George Harms land, south of Platteville, and is sinking a shaft.

Vandeventer—Shipments are again being made from this mine, which is under lease to R. Fox & Co.

Canada

British Columbia

Idaho-Alamo—W. E. Finch, of Spokane, Wash., and associates, are doing development work on this group of mines in the Slocan district. The lower old tunnels of both mines are being extended, and a low-level adit is being driven to cut the Alamo vein at 450 ft. greater depth. Both properties were large producers of silver-lead ore in previous years, and on both there is much virgin ground.

Noble Five—Four main levels and several intermediates have been driven on the Deadman vein of this group on Cody Mountain, in the Slocan district. Both silver-lead and silver-zinc ore have been opened in considerable quantities on all levels. The ore generally is high grade, the zinc ore exceptionally so for this part of the province. A carload shipment was recently sent to Bartlesville, Okla., and more ore will soon be shipped.

British Columbia Copper Co.—This company has taken under option of purchase the Eureka mine, which is about nine miles from Nelson, West Kootenay. It is stated that there is a fair tonnage of ore in sight, containing copper and some gold and silver.

Motherlode Sheep Creek Mining Co.—During July, 1860 tons of ore was crushed in 29½ working days. The heads assayed $17.28 per ton; 97.98% of which was recovered. The total production of gold and silver was worth $31,497; the working costs totaled $12,210.

British Columbia—Atlin District

North Columbia Gold Mining Co.—This company has been operating its own holdings on Pine Creek and also those of the Atlin Consolidated Mining Co. Since the commencement of the season, a force of about 50 men has been employed, and about 14 monitors are in constant use. Several shipments of gold have been made. This company does not suffer from shortage of water. Surprise Lake, about 16 miles long, is being utilized as a reservoir. J. M. Ruffner, manager.

Birch Creek Hydraulic Mine—At this mine, on Birch Creek, the early part of the season was occupied in moving and reinstalling plants in a position to give increased pressure. Since the completion of this work, steady progress has been made, but piping has been somewhat retarded through extreme shortage of water. Cleanups maintain the usual average, and several shipments have been made. H. Peplow Pearse, manager.

Ontario

Silver Islet—This property, on the north shore of Lake Superior, which was at one time a producer, but has been idle for many years on account of flooding, is to be reopened.

Ontario—Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended Aug. 23, and for the year to date, are:

Beaver	24.51	244.26
Buffalo	29.95	738.39
Casey Cobalt	.....	212.15
City of Cobalt	.....	855.26
Cobalt Lake	26.06	523.82
Cobalt Townsite	37.85	1,045.16
Chamb.-Ferland	.....	257.05
Coniagas	.....	1,351.46
Crown Reserve	26.54	351.10
Drummond	.....	330.30
Hudson Bay	62.80	502.86
Kerr Lake	30.30	504.93
La Rose	32.60	2,261.86
Lost and Fourd	.....	15.00
McKinley-Darragh	29.40	1,769.49
Nipissing	30.96	1,475.44
O'Brien	.....	345.62
Penn.-Canadian	29.70	29.70
Provincial	.....	22.22
Right of Way	30.61	210.62
Timiskaming	.....	744.93
Trethewey	.....	353.89
Wettlaufer	.....	229.04
Totals	391.28	14,424.58

Ophir—Development work to date has failed to open any high-grade ore. Much milling ore has been found on the 300-ft. level.

Penn.—Canadian—This company, which is operating the old Cobalt Central mine, is shipping high-grade ore. The mill is being overhauled, and will be operating soon.

Ontario—Porcupine

Dome—The daily average of ore crushed during July is, semi-officially, stated at about 350 tons, the highest tonnage for any one day being 386 tons. A block of ore directly below the big mound of quartz on the surface has been opened in the crosscut at the 200-ft. level and will be connected with the mill by a raise. The Golden Stairway vein will be connected with the second level at the main underground workings by a drift through which the ore will be conveyed to the crusher.

Dome Extension—The result of development has so far been disappointing. The crosscut driven at the 230-ft. level to the contact of the quartz-porphyry with the slate, discovered numerous quartz stringers, but they appear too small and broken to yield pay ore. Drifting from the Eastern shaft, which is down 100 ft., discloses ore showing gold, but the grade is low.

Mexico

Jalisco

San Pedro Analco—The U. S. Smelting, Refining & Mining Co., has an option on this mine. If the purchase of the property is made a hydro-electric plant will be built. The Negociacion Minera de San Pedro Analco built a dam across the Santiago River for such a plant some time ago.

Mexico

Esperanza—During the month of July the mill was in operation 28 days, crushing 5999 tons of ore and treating 14,349 tons of tailings, from which bullion was produced worth $99,646. Receipts from rents and other sources amounted to $619 bringing the total up to $100,265. The working expenses including developments and marketing of bullion were $72,761; the allowance for depreciation of plant was $5000, the New York office expenses $197, a total of $77,958, leaving a difference of $22,307 or £4576. As the London expense was £250, the net estimated profit was £4326.

Nuevo Leon

Peñoles Mining Co.—This company has purchased the Palomas mines, and is contemplating the purchase of the Cabrillas and Mariposas properties, all in the same district.

Sinaloa

Potrero—It is reported that machinery and building material for the construction of a 60-ton stamp mill has arrived at Guaymas and is being hauled from Casal 35 miles to this mine, where a fair tonnage of gold ore is said to be ready for the mill. There are about 50 men employed in the mine. J. J. MacNervey, superintendent.

Sonora

San Antonio—This property at San Antonio de la Huerta, in the Yaqui Valley, may soon be a producer. Some ore has been blocked out and is ready for extraction. A branch railroad, seven miles long, connecting with the terminus of the Southern Pacific of Mexico at Tonichi, is being constructed, the grading already being completed. Several hundred men have been working steadily and over 2000 ft. of development work has been done monthly for some time.

Cerro de Plata—This property is 30 miles east of Imuris. It is said that development is being attended with excellent results. E. B. Holt, manager.

Gueriguito—This mine is 35 miles below Nacozari, and in a short time the company will install an oil engine to furnish power for the mill.

Duluth-Sonora—It is reported from Duluth, Minn., that development operations will be resumed at this mine by Oct. 1. No work has been done on the property during the last three years.

Africa

Transvaal

Gold production in the Transvaal in July was 766,338 oz., being 12,402 oz. more than in June, and 57,080 oz. more than in July, 1911. For the seven months ended July 31, the total was 4,605,405 oz. in 1911, and 5,311,245 oz.—or $109,783,434—in 1912; an increase of 705,840 oz. this year. The number of negro laborers employed at the end of July was 207,256, a decrease of 5317 from the previous month.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Aug. 28—The seaboard bituminous trade shows increasing activity. Sales are larger and prices are firmer, though there has been no general advance. Coastwise trade is active.

The anthracite companies are still working hard to make up the shortage resulting from the stoppage of production in April and May. Demand is strong and deliveries cannot be made as fast as they are wanted. The last of the summer discounts goes off Sept. 1, and seaboard prices will then be at the full schedule.

In the West trade is also active and prices are firmer. Consumers are beginning to put in stocks for winter, and the demand for steam coal is good. The Lake trade is moving well so far as bituminous coal is concerned, though anthracite shipments are still much behind last year.

Anthracite shipments in July were 6,285,153 long tons, being 1,481,088 tons more than in July, 1911, and the largest shipments were reported in a summer month. The shipments, however, have not yet made up the shortage caused by the April-May stoppage. For the seven months ended July 31 the total was 40,113,648 long tons in 1911, and 32,382,132 in 1912; a decrease of 7,731,516 tons, or 19.3%, this year.

Coal and coke tonnage of all lines of the Pennsylvania R.R. east of Pittsburgh and Erie, seven months ended July 31, short tons:

	1911	1912	Changes
Anthracite	6,817,754	5,525,010	D. 1,292,744
Bituminous	23,162,859	26,175,168	I. 3,012,309
Coke	6,064,148	7,451,340	I. 1,387,192
Total	36,044,761	39,151,518	I. 3,106,757

The total increase this year was 8.6%. The decrease in anthracite was due to the stoppage of mining in April and May.

Coal passing through Sault Ste. Marie canals, season to Aug. 1, short tons:

	1911	1912	Changes
Anthracite	938,432	505,225	D. 433,207
Bituminous	5,899,591	5,981,229	I. 81,638
Total	6,838,023	6,486,454	D. 351,569

The total decrease this year was 5.1%; being entirely in anthracite.

Belgian Coal—Coal production in Belgium, six months ended June 30, was 11,546,670 metric tons in 1911, and 11,135,290 in 1912; decrease, 411,380 tons. Stocks at mines, June 30, 1912, were 627,220 tons, a decrease of 255,150 tons from last year.

British Coal Trade—Exports of fuel from Great Britain, with coal sent abroad for the use of steamships in foreign trade, seven months ended July 31, long tons:

	1911	1912	Changes
Coal	36,373,517	33,215,189	D. 3,158,328
Coke	545,210	474,086	D. 71,124
Briquettes	981,094	827,228	D. 153,866
Total exports	37,899,821	34,516,503	D. 3,383,318
Steamer coal	11,090,042	9,758,398	D. 1,331,644
Total	48,989,863	44,274,901	D. 4,714,962

Imports of coal for the seven months were 12,551 tons in 1911, and 179,398 in 1912; increase, 166,847 tons.

Iron Trade Review

New York, Aug. 28—The iron and steel trades continue to show the same degree of activity that has characterized them during the past month. Takings on contracts are large, and new buying is strong in almost all lines. It is claimed that the buying is almost entirely for consumption and that there is very little speculative business. This view seems to be corroborated by the fact that sales are not discouraged by the gradual creeping up of prices; and also by the prevalence of some urgency for early deliveries.

Throughout the steel industry, interest centers in deliveries. There is very little new buying for late delivery, but heavy specifications on contracts continue, and there are many fresh purchases of small lots for early delivery, sometimes at premiums above current quotations, though the amount of premium business is usually greatly exaggerated. It must be remembered that present open quotations represent large advances over prices which large buyers are paying on the bulk of their deliveries.

Production of steel is now fully up to the June rate, and represents practically all the effective capacity, though full outputs are not always secured, on account of the scarcity of labor. While the labor shortage is serious in all sections, it is probably most acute in the East. Yesterday's advance of $1 a ton in wire products makes Pittsburgh prices as follows: Wire nails, base, $1.70; plain wire, 1.50c.; painted barb wire, 1.70c.; galvanized barb wire, 2.00c. The wire mills have been only moderately busy and the advance is expected to stimulate specifications on old contracts, particularly as the active fall season is approaching. Nails are still $7 a ton below the high point of 1907, although they are $2 a ton above the low point of 1909 and $4 a ton above the low point late last year, the lowest since 1899.

Buying of pig iron has been heavier, some large contracts for basic pig having been placed in the Central West, while foundry iron has sold freely in the East. Prices are firmer, and a general advance of at least 25c. per ton can be reported on almost all kinds of iron. Many contracts now being made run over the first quarter of next year.

Birmingham

Aug. 26—The market is stronger in Southern territory, and quotations are going up. While $12 per ton for No. 2 foundry is still named, $12.25@12.50 is also asked for fourth-quarter contracts, and the higher figure will soon be general. Stocks of pig iron are down to a low point now, and increased production will soon be necessary. Two additional furnaces will be put in blast before long.

Steel works at Ensley and Gadsden are running well and more orders are reported coming.

Chicago

Aug. 27—The iron market continues firm with sales of pig iron quiet but making a good aggregate volume, and the demand for finished products heavy. There is now a tendency of melters to buy for first-half needs, at the prices of the furnace agents, which in general are 50c. over prices for corresponding material delivered in the last quarter. Some No. 2 Southern foundry iron is being sold in small lots for early delivery at $12 Birmingham, which means $16.35 Chicago, but $12.50 is the ruling price on first-quarter deliveries and $12.25 is said to represent some sales extending over the first of the year. Northern No. 2 foundry iron holds to $15.50@16 at furnace, which means about $16@16.50 delivered. Charcoal iron brings $16.50@17, Chicago, and is in good demand.

A few sales of between 1000 and 2000 tons of pig iron have been recorded, but most of the business is in small lots bought often. Inquiries on first-quarter and first-half supplies are numerous and it is evident that the larger melters will buy on any indication of a turn upward in prices. Some furnace agents seem so confident of the future that they hold out for $13 on Southern No. 2 on business distributed over the first-half and $16 as a minimum for Northern No. 2 similarly delivered.

The local mills continue so crowded to meet deliveries up to the first of the year that little new business is solicited and

while contracts for 1913 supplies are gradually increasing, there is much uncertainty about them. For railroad supplies and structural material the demand is large and steady. Iron bars hold to 1.40c. with soft-steel bars at 1.48c., with the demand in excess of the supply so far as local mills are concerned. Plates, sheets and minor lines are very strong.

Cleveland

Aug. 26—Movement of ore on the Lakes continues heavy, though there has been some delay to vessels from fogs and bad weather.

Pig Iron—Sales have been heavy and some large contracts for basic are reported placed on a sliding scale, which is not quoted. Bessemer is quoted $15.15 @15.30; No. 2 foundry, $13.75@14.25; gray forge, $13.25@13.75, Lake Superior charcoal, $16.25@16.50, all Cleveland delivery.

Finished Material—Buyers are pressing for early deliveries, and some premiums are being paid. Prices are strong. Jobbers report a heavy demand all around, and have generally advanced prices for material from store.

Philadelphia

Aug. 29—Consumers of pig iron in territory which looks here for supplies have apparently become somewhat alarmed over the extraordinary demand and the rapid disappearance of stocks. This is shown by the large number of pressing inquiries from small consumers, who are readily paying the advanced prices ranging from 25 to 50c. per ton. The greatest activity in sight is in steel-making grades for winter delivery. Makers of basic pig are less disposed than two weeks ago to accept business for first quarter next year. No serious difficulty, however, will interfere with final satisfactory arrangements. Makers will insist on at least present outside quotations. Nearly all the mills in this district have arranged for further supplies of forge iron, in some cases orders extending throughout the first quarter. Buyers of No. 2X foundry have been particularly active in looking after fourth-quarter necessities and several southern furnaces have succeeded in securing a fair share of the business that is drifting into the market. Quotations for No. 2X foundry are $16@16.25; gray forge, $15.50@15.75. Low phosphorus is picked up at $20.50 per ton.

Steel Billets—Billets are again under active request, with an advance of at least $1 per ton. A minimum price for openhearth today is $25.40 per ton.

Bars—While no open advance in bars has been made, buyers are forcing prices upward fractionally and steel bars are decidedly higher. Jobbers are especially anxious to obtain deliveries on supplies ordered some time ago on which the mills are rather slow.

Sheets—Sheets have also advanced in a premium way for early deliveries and manufacturers have been obliged to divide up and accept only a part of the business offered and make the best promises they are able as to the rest.

Pipes and Tubes—The same stringent conditions heretofore mentioned prevail in all branches of this industry. The consumption of tubes is heavier than for two or three years. The smaller tube-using plants are being heard from and delivery is more thought of than price.

Plate—Premiums have characterized the business in plates placed this week. The regular advance amounts to $1 per ton, in most cases.

Structural Material—Large local requirements have been recently covered and other large requirements are standing in line wherein deliveries cover the last quarter of this year and the first of next. There is a general hustling to place orders.

Scrap—The pressure for railroad No. 1 wrought and other kinds of desirable scrap has stimulated the dealers to renewed efforts. The supply is barely equal to the demand.

Pittsburgh

Aug. 27—The advance in wire products made on Aug. 26, by the American Steel & Wire Co., and immediately followed by the independents, is the fourth $1 a ton advance since the low point which occurred at the beginning of last December. In an advancing market for wire products the question is not what is the current price, but how much tonnage the mills will admit at lower-priced contracts. The present advance, to a $1.70 basis for nails, will probably eliminate all contracts at $1.60 or under.

Prices of steel products are very firm all along the line, and there are reports that plates and shapes may advance another $1 a ton shortly. The independents are all quoting 1.40c. on plates and shapes. The Steel Corporation has not made a formal advance, but is accepting little if any business at 1.35c. In bars the Corporation is selling to a limited extent at 1.30c., but in jobs where deliveries run into next year it is demanding 1.35c. The independents as a rule are quoting 1.35c. as a minimum. The sheet market is strong and an advance is likely within 30 days. There is fresh demand for tinplate.

Ferromanganese—Effective yesterday, an advance of $2.50 was made by the English producers of ferromanganese, making the price $53.50, Baltimore, with $1.95 freight to Pittsburgh. There was fairly heavy covering for the first half of next year before the advance to $51, and the great bulk of the first-half consumption is now under cover. Prompt metal commands substantially the same price as contract.

Pig Iron—The local market has suddenly displayed a strong advancing tendency, following the slow stiffening which has been in progress for months. It is doubtful whether any round tonnage of bessemer could be secured at $14.75, Valley, or basic at $14, Valley, although these are the regular quotations. In foundry iron the $14 price has not only disappeared, but sales have been made for first quarter at advances over the higher price now ruling for this year. One sale of a round tonnage of No. 1 foundry was made late last week at $15.50, furnace, equal to $15 for No. 2, for delivery over the first quarter, and the seller is maintaining a minimum price of $14.50 for this year and $15 for first quarter. While there is no more iron at $14, furnace, there is probably a little to be had at $14.25, and the market for foundry iron is quotable at $14.25@14.50 for this year and $15, furnace, for first quarter, prices delivered Pittsburgh being 75 to 90c. higher, according to freight rates. The market for other grades is strictly on a Valley basis: Bessemer, $14.75@15; basic, $14@14.25; malleable, $14, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh. It has developed lately that the furnaces now in operation are quite well sold up for this year and there are few idle furnaces in position to get into blast.

Steel—Practically famine conditions prevail in steel, and consumers are paying fancy prices for small lots, as they cannot always secure all they need on their regular contracts. A sale of a small tonnage of openhearth billets was made within the past couple days at within a few cents of $25, delivered in this district. The regular market is quotable about the same as last week, subject to premiums on small lots for quick delivery: Bessemer billets, $22.50; bessemer sheet bars, $23; openhearth billets, $23; openhearth sheet bars, $23.75@24, f.o.b. maker's mill, Pittsburgh or Youngstown. Rods are quiet at $25@26, Pittsburgh, with the tendency toward the higher figure.

Sheets—The market is firm at the regular quoted prices, there being probably not a single mill willing to shade anything, but occasionally jobbers are offering limited tonnages at cut prices, a common occurrence when the market has had several successive advances. About 85% of the sheet mills are in operation, this being as many as can be run with the present supply of steel, and labor so scarce. We quote: Blue annealed, 10 gage, 1.50c.; black sheets, 28 gage, 2.05c.; galvanized, 28 gage, 3.15c.; painted corrugated, 2.20@2.25c.; galvanized corrugated, 3.10@3.20c., both for 28 gage.

Connellsville Coke—There does not

seem to have been any further contracting since last report, but sales have been made of about 10,000 tons of prompt furnace coke at $2.25. The sales of prompt coke in the past three weeks have been largely to furnaces already provided with contracts, the furnaces apparently wishing to accumulate a little surplus against possible interruptions to their shipments later in the year. Both prompt and contract furnace are quotable at $2.25, but some operators are holding contract at $2.35 or higher. Foundry coke is $2.40@2.75, according to brand and delivery.

St. Louis

Aug. 26—Business is more active, with larger sales. For Southern No. 2 foundry $12 Birmingham, or $15.75 St. Louis, is asked, with intimations that a 25c. or 50c. advance may be expected. Northern No. 2 is quoted at $15.75, and an advance is expected. Business in steel products is improving.

Iron Ore Trade

Out of the total shipments of 7,600,233 tons of iron ore from the Lake Superior region reported in July, 6,086,254 tons, or 80.1%, were delivered to Lake Erie ports.

Little or no new business is reported in the East. Furnaces are generally supplied for the year, and neither sellers nor buyers are inclined to contract yet for next year. Ocean freights on foreign ores are still at a high level.

German Ore Trade—Imports and exports of iron and manganese ores in Germany six months ended June 30, metric tons:

	1911	1912	Changes
Iron ore, imp.....	5,095,877	5,677,719	I. 581,842
Iron ore, exp.....	1,292,841	1,089,628	D. 203,213
Manganese, imp.....	210,470	192,040	D. 18,430
Manganese, exp.....	2,537	3,135	I. 598

Imports of slag and slag products in 1912 were 614,112 tons; exports were 52,125 tons.

Foreign Iron Trade

German Iron Production—The German Iron & Steel Union reports the production of pig iron in the German Empire in June at 1,418,445 tons, or 45,232 tons less than in May. For the six months ended June 30 the total make was, in metric tons:

	1911	1912	Changes
Foundry iron	1,534,625	1,552,551	I. 17,926
Forge iron.....	279,293	268,792	D. 10,501
Steel pig.....	850,423	1,037,902	I. 187,479
Bessemer pig.....	169,325	193,763	I. 24,438
Thomas(basic)pig	4,848,973	5,371,624	I. 522,651
Total..... ...	7,682,639	8,424,632	I. 741,993

Total increase this year, 9.7%. Steel pig includes spiegeleisen, ferromanganese and all similar alloys.

Belgian Production—Pig-iron production in Belgium six months ended June 30 was: Forge, 16,555; foundry, 46,959; basic and bessemer, 1,058,047; total, 1,121,561 metric tons; an increase of 97,561 tons over last year.

Metal Markets

New York, Aug. 28—The metal markets are generally unchanged, except that there is rather more firmness in most lines.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
July 1912..	$ 7,263,624	$ 3,747,869	Exp. $3,515,755
" 1911..	2,178,088	2,594,653	Imp. 416,565
Year 1912..	40,660,460	29,012,211	Exp. 11,648,249
" 1911..	15,429,650	36,367,679	Imp. 20,938,029
Silver			
July 1912..	6,591,054	3,449,716	Exp. 3,141,338
" 1911..	5,275,008	3,920,794	Exp. 1,354,214
Year 1912..	40,260,276	28,713,965	Exp. 11,546,311
" 1911..	39,718,211	25,881,395	Exp. 13,836,816

Exports from the port of New York, week ended Aug. 24: Gold, none; silver, $771,754, chiefly to London. Imports: Gold, $575,102, from South America and Mexico; silver, $114,912, largely from South America.

Gold—The price of gold on the open market in London remains at the Bank level, 77s. 9d. per oz. for bars, and 76s. 4d. per oz. for American coin. The supplies arriving went to the Bank of England, with the exception of a reservation for India.

Platinum—The market is rather quiet and there is some talk of lower prices, but they have not yet materialized. Dealers still ask $45.50 per oz. for refined platinum and $48 per oz. for hard metal.

Our Russian correspondent writes, under date of Aug. 15, that sales of platinum continues small in comparison with those in the same season of the previous year. The tendency of the large producers is not to lower the prices in any event. From Paris it is reported there are large stocks of platinum held by the Compagnie Industrielle du Platine, which controls 85% of the platinum produced in Russia. Small lots of platinum can be obtained in Ekaterinburg at a low price. Officially the prices remain unchanged. The metal is quoted in St. Petersburg at 37,500 rubles per pood; at Ekaterinburg 9.80 rubles per zolatnik, both for crude metal, 83% platinum. These prices are equivalent to $36.75 and $36.85 per oz., respectively.

SILVER AND STERLING EXCHANGE

Aug.	22	23	24	26	27	28
New York....	62⅜	62¼	62¼	62	61⅝	61¾
London .	28 11/16	28⅝	28⅝	28 9/16	28⅜	28 7/16
Sterling Ex..	4.8720	4.8720	4.8715	4.8715	4.8730	4.8725

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Silver—The market has ruled dull with lower tendency, touching 28⅜d. on Aug. 27, but closes steady on Indian Bazaar buying at 28 7/16d. in London.

Exports of silver from London to the East, Jan. 1 to Aug. 15, as reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India.....	£5,100,600	£5,010,700	D. £ 89,900
China.... ...	890,400	933,500	I. 43,100
Total	£5,991,000	£5,944,200	D. £ 46,800

Exports of gold from London to India in July were £1,327,494. For the seven months ended July 31 the total was £8,851,351, an increase of £2,011,366 over last year.

Coined silver in the United States, Aug. 1, as estimated by the Treasury Department: Standard dollars, $565,368,367; subsidiary coins, $170,680,698; total, $736,049,065. Of the dollars $487,825,000 are held in the Treasury against silver certificates outstanding.

Copper, Tin, Lead and Zinc

NEW YORK

	Copper		Tin	Lead		Zinc	
Aug.	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
22	17½ @17¾	17.45 @17.55	46⅛	4.50	4.37½ @4.42½	7.05 @7.15	6.90 @7.00
23	17⅝ @17¾	17.50 @17.60	46¼	4.50	4.40 @4.42½	7.10 @7.20	6.95 @7.05
24	17⅝ @17¾	17.57½ @17.60	46¼	4.50	4.40 @4.42½	7.10 @7.20	6.95 @7.05
26	17⅝ @17¾	17.57½ @17.60	46¼	4.65	4.55 @4.60	7.10 @7.20	6.95 @7.05
27	17⅝ @17¾	17.57½ @17.60	46¼	4.65	4.55 @4.60	7.10 @7.20	6.95 @7.05
28	17⅝ @17¾	17.57½ @17.60	46⅛	4.65	4.55 @4.60	7.15 @7.20	7.00 @7.05

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—Following the sporadic purchases by Europe at the end of our last week, the market steadily acquired a firmer tone and about Aug. 23 became active and strong. Since then a large business, running to millions of pounds, has been transacted, both for foreign and domestic shipment, the latter apparently predominating, and upon most of this business the full price of 17¾c., delivered, usual terms, was realized. The European consumers had been out of the market for over two months, and it is noteworthy that their orders now call for early shipment. Further large orders from Europe are anticipated. In this country, consumption is excellent and seems to be limited only by the capacity to turn out manufactured goods. At the

LONDON

Aug.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'td	Spot	3 Mos		
22	79⅛	79 1/16	84⅛	209½	208	19¾	26½
23	79⅛	79 1/16	84⅛	210½	209¼	20	26⅝
24	....	....	....	.....	.....	....	....
26	79⅜	79⅜	84⅛	210¾	209¼	20¼	26⅝
27	79⅜	79⅜	84⅜	210¼	209	20¼	26¾
28	79⅛	79¾	84⅛	211½	210⅞	20⅛	26¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 21¾c.

close, Lake copper is quoted at 17⅝@17¾c.; electrolytic copper in cakes, wirebars and ingots at 17.57½@17.60c. Casting copper is quoted nominally at 17⅜@17½c. as an average for the week.

The market for standard copper has been firm, and has fluctuated within comparatively narrow limits, spot and three months holding around £79 10s. While for some time past, three months' copper has been selling at or below the price of spot, during the last few days there is again a contango, the market closing at £79 10s. for spot, and £79 15s. for three months.

Copper sheets have been advanced 1c. and are now 23@24c. per lb., base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 19@19¼c. base, carload lots at mill.

Copper exports from New York for the week were 8063 long tons. Our special correspondent gives the exports from Baltimore at 2741 long tons for the week.

Tin—The market has been strong and advancing, due more to the purchases on part of the dealers in Europe than to those of American consumers. The latter, at the moment, seem to be well supplied by the arrival of shipments which had accumulated on account of the dock strike. The statistical position of the metal is a strong one, and it is reported that the output of the Straits during the second half of this year is not likely to show the same increase which the first half year showed. Consumption the world over is good. Prices have fluctuated from 46c. to 46½c., at which latter figure the market closes.

In London, the market on Aug. 22 hung around £209 10s. for spot and £208 for three months. It advanced about £1 on Aug. 23, and held this advance for the next few days. The market closes strong at £211 10s. for spot, and £210 17s. 6d. for three months.

Lead—Consumption is excellent, and the statistical position of this article is a strong one. On Monday, Aug. 26, the principal producers advanced their price to 4.65c., New York, and there is a good demand at the higher level. Lead at St. Louis is selling at 4.55@4.60 cents.

In Europe, the market is very firm, and the scarcity for early shipment continues. At the close, Spanish lead for early delivery is quoted £20 10s., and English £20 12s. 6d. per ton.

Spelter—The market is without special feature. There has been a fair business done at slightly higher prices, and at the close St. Louis is quoted 7@7.05c., and New York 7.15@7.20 cents.

The London market is firm, and prices have advanced slightly, good ordinaries being quoted at £26 15s., and specials at £27 per ton.

Base price of zinc sheets is $8.75 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7¼@7⅜c. per lb. in carload lots, New York.

Other Metals

Aluminum—Business is active, but metal is still rather scarce for early delivery. The current quotation is 24¼@24½c. per lb. for No. 1 ingots, New York.

Antimony—The market is firm and sales are good. Prices are strong except for occasional small sales in liquidation of purchases made before the recent advances. Cookson's is quoted 8.60c. per lb.; Hallett's and U. S., 7.95@8.05c., while 7.65@7.75c. is asked for Chinese, Hungarian and other outside brands.

Quicksilver—Business is fair, but prices are a little easier. New York quotations are $42 per flask of 75 lb. San Francisco, $41.50 for domestic orders and $39 for export. The London price is 5s. lower, at £7 15s. per flask, with the same price from second hands.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Cadmium—The quotation continues at 700 marks per 100 kg., f.o.b. works in Silesia, Germany. This is equal to 75.6c. per lb., at works.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots f.o.b. New York.

Nickel—Shot, blocks, plaquettes bring 40@45c. per lb., according to quality. Electrolytic nickel is 3c. per lb. higher.

Spanish Metal Exports

Exports of metals and minerals from Spain, five months ended May 31, as reported by *Revista Minera*, in metric tons:

Metals	1911	1912	Changes	
Pig and manuf. iron	20,525	25,013	I.	4,488
Copper	6,360	9,297	I.	2,937
Copper precipitate	6,924	5,609	D.	1,315
Lead	65,435	76,524	I.	11,089
Zinc	620	1,302	I.	682
Quicksilver	1,028	1,472	I.	446
Minerals				
Iron ore	3,549,263	3,465,357	D.	83,906
Manganese ore	13,914	11,003	D.	2,911
Copper ore	172,344	72,787	D.	99,557
Lead ore	1,335	1,571	I.	236
Zinc ore	63,926	48,651	D.	15,275
Pyrites	980,694	1,188,375	I.	207,681
Salt	247,783	277,388	I.	29,605

Pyritic ores are now classed as pyrites unless they carry 2.5% or over in copper. Last year the dividing line was 1% copper.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 24—The high price of zinc sulphide ore was $60, the base per ton of 60% zinc $53@57. Zinc silicate sold on a base of $30@31 per ton of 40% zinc. The average price, all grades of zinc, was $51.04. The high price of lead was $59, the average, all grades, $56.22, there being a lighter demand, with lower prices on medium- and lower-grade ores.

SHIPMENTS, WEEK ENDED AUG. 24

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	5,659,680	.....	949,950	$185,010
Joplin	3,814,360	.....	288,100	115,150
Galena	714,930	.....	132,820	23,445
Duenweg	697,270	.....	96,640	22,220
Jackson	727,230	.....	.....	20,560
Miami	421,120	.....	154,080	14,835
Alba-Neck	443,140	.....	12,750	13,200
Granby	103,470	468,650	9,200	9,970
Carl Junction	262,640	.....	.....	7,870
Oronogo	262,860	.....	.....	7,185
Spurgeon	.....	315,390	44,330	6,285
Springfield	197,500	.....	.....	5,725
Cave Springs	181,570	.....	5,600	5,055
Sarcoxie	156,340	.....	.....	4,065
Lawton	150,000	.....	.....	4,275
Aurora	.....	128,920	.....	2,315
Wentworth	61,350	.....	.....	1,195
Totals	13,853,460	912,940	1,695,470	$448,760
34 weeks	351,942,250	21,796,970	60,032,230	$11,168,035

Blende val., the week, $386,600; 34 weeks, $9,169,289
Calamine, the week, 14,490; 34 weeks, 330,912
Lead value, the week, 47,670; 34 weeks, 1,668,334

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February	40.21	45.75	39.16	43.31	54.46	52.39
March	39.85	51.56	38.45	49.25	54.57	54.64
April	38.88	52.00	37.47	50.36	56.37	54 18
May	38.25	55.30	36.79	53.27	55.21	52.45
June	40.50	55 88	38.18	54.38	56.49	55.01
July	40.75	58.85	38.36	56.59	58.81	58.83
August	42.50	.....	41.28	.....	60.74	.....
September	42.63	.....	41.29	.....	59.33	.....
October	42.38	.....	40.89	.....	54.72	.....
November	45.40	.....	43.25	.....	57.19	.....
December	44.13	.....	40.76	.....	62.03	.....
Year	$41.45	.....	$39.90	.....	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Platteville, Wis., Aug. 24—The base price paid this week for 60% zinc ore was $52@55. The base price paid for 80% lead ore was $56@58 per ton.

SHIPMENTS, WEEK ENDED AUG. 24

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Benton	796,200	.....	521,800
Mineral Point	712,230	.....	.....
Highland	636,000	.....	.....
Platteville	583,600	.....	196,700
Shullsburg	530,000	.....	.....
Hazel Green	380,000	.....	.....
Galena	324,900	.....	.....
Harker	304,370	.....	.....
Cuba City	216,920	.....	237,000
Rewey	83,000	.....	.....
Linden	80,000	.....	.....
Total	4,647,220	.....	955,500
Year to date	133,819,380	5,887,420	22,326,37

Shipped during week to separating plants, 2,936,450 lb. zinc ore.

Other Ore Markets

Rates on Manganese Ore—Cancellation recently by the Central R.R. of New Jersey of the privilege to shippers of imported manganese ore, of having the ore crushed at Elizabethport, N. J., and thence reshipped at the import rate, increased charges on the reshipped ore $1.40 per ton. The Interstate Commerce Commission regards this advance as unreasonable and on Aug. 22 suspended it until Dec. 21.

New Caledonia Ores

Exports of ores from New Caledonia, as reported by the *Bulletin du Commerce,* of Noumea, for the six months ended June 30, were 23,842 metric tons of nickel ore and 25,992 tons of chrome ore. Shipments of metals were 1675 tons of nickel matte.

Chemicals

New York, Aug. 28—The general market reports some increase in activity.

Arsenic—Spot supplies are still scarce. Only small supplies of English and Mexican material are in the market. Quotations are $5 per 100 lb. for spot; while futures, at $4@4.50 per 100 lb., are rather neglected.

Copper Sulphate—The demand is steady. Prices are unchanged at $5.50 per 100 lb. for carload lots, and $5.75 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is rather quiet, but prices are maintained, chiefly on account of high ocean freights. Spot is quoted at 2.50c.; futures are higher, 2.52½@2.55c. per lb. being asked for October-November deliveries; 2.57½c. for December, and 2.60c. for January and later.

Potassium Salts—Exports of potassium salts from Germany, six months ended June 30, metric tons:

	Total	To U.S.
Crude salts	609,390	270,769
Potassium chloride	150,285	98,210
Potassium sulphate	45,519	16,885
Pot-magnesium sulphate	38,126	4,572
Total	843,320	390,436

Comparisons with 1911 cannot be made, owing to changes in the official classification this year. The exports to the United States were 46.3% of the total.

Mining Stocks

New York, Aug. 28—On Aug. 21 the dullness of the Exchange was only relieved by the continued activity in copper shares. Amalgamated at 88¼ made a new high record since 1910. Chino, Tennessee and Utah made fractional gains. The Curb coppers were active also, Greene-Cananea and Braden leading.

On Aug. 22 there was an increase of 125,000 shares over Monday's sales, but there was a general, though unimportant, decline in prices. Amalgamated sold up to 88⅜. The Curb market was mixed. Old Standard Oil was quoted at $1080 bid. Greene-Cananea was again strong.

On Aug. 23 trading was without special interest. The coppers fell off slightly. On the Curb trading was also sluggish.

Aug. 26-28 there were few changes in the market, the Exchange being irregular and without definite tendency. On the Curb copper stocks were fairly active and firm, the general tendency being upward. Cobalts sold well, at small advances. There were moderate dealings in other mining stocks, at firm prices.

At auction in New York, Aug. 22, the following sales were made: Camp Bird Mining Co., 50 shares, $6 per share; California-Nevada Copper Co., $7500 bonds, 5½% of par; 750 shares, $5 par, $5 for the lot; U. S. Steel Corporation, $2,000,000 bonds, 102⅝% and interest; Colorado Fuel & Iron Co., 50 shares preferred, $100 per share.

Boston, Aug. 27—The copper-share market received quite a push in the increasing of the Calumet & Hecla dividend from $10 to $12 quarterly. It has resulted in giving confidence to the situation and is being reflected almost daily in the share market. Many stocks have risen to the highest price of the year, and the air is surcharged with optimistic sentiment

Calumet & Hecla made the equivalent of a $25 advance, selling at $550, ex-dividend. Calumet & Arizona and North Butte have been the most conspicuous stocks, both making record prices for the year. Calumet & Arizona is up $82.50 on increased dividend prospects. There have been unconfirmed reports that the Amalgamated would take these and other mines over in due time.

A sharp rise in Old Dominion Mining shares to $61, the highest price for many years, also gives encouragement. Copper Range also attracts attention with its $6 rise to $63.75. Granby is another strong spot. Other strong spots have been Boston & Corbin and Santa Fé.

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield thereof is reckoned at 95%. In computing the total American supply duplications are excluded.

Company	May	June	July
Alaska shipments	1,720,391	4,134,569	2,224,441
Anaconda	25,800,000	.....	.....
Arizona, Ltd	3,500,000	3,300,000	3,200,000
Copper Queen	7,024,087	7,622,730	7,708,147
Calumet & Ariz	4,424,000	4,160,000	4,748,000
Chino	1,275,850	1,474,979	2,945,000
Detroit	2,092,478	1,959,634	2,194,090
East Butte	1,445,000	.....	.....
Mammoth	1,760,000	.....	.....
Mason Valley	1,520,000	1,438,580	1,500,000
Nevada Con	6,063,462	5,913,832	6,084,274
Ohio	685,000	665,000	.....
Old Dominion	2,180,000	2,130,000	.....
Ray	2,924,913	3,004,195	2,985,965
Shannon	1,464,000	1,270,000	1,446,000
South Utah	236,884	162,335	142,555
United Verde*	2,500,000	2,500,000	.....
Utah Copper Co	9,564,919	8,772,742	10,602,000
Lake Superior*	21,250,000	15,600,000	19,500,000
Non-rep. mines*	8,400,000	8,300,000	8,970,000
Total production	105,830,984	.....	.....
Imports, bars, etc.	25,836,519	24,262,292	.....
Total blister	131,697,503	.....	.....
Imp. in ore & matte	6,410,226	8,404,936	.....
Total American	138,107,729	.....	.....
Miami†	2,676,702	2,683,310	3,027,710
Brit. Col. Cos.:			
British Col. Copper	875,000	996,000	1,026,000
Granby	1,914,460	1,888,400	.....
Mexican Cos.:			
Boleo†	2,260,160	1,851 920	2,386,480
Cananea	4,600,000	4,310,000	4,000,000
Moctezuma	2,892,521	3,176,819	3,094,016
Other Foreign:			
Cape Cop., S. Africa	754,880	.....	.....
Kyshtim, Russia	.....	.....	.....
Spassky, Russia	694,400	757,120	795,200
Famatina, Argen	.....	.....	.....
Tilt Cove, Newf'd	123,087	.....	.....
Exports from:			
Chile	3,696,000	9,856,000	8,960,000
Australia	7,840,000	8,176,000	8,288,000
Arrivals in Europe‡	9,976,860	12,667,200	14,114,240

†Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

‡Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	U.S.Refin'y Product'n	Deliveries, Domestic	Deliveries for Export
VII, 1911	112,167,934	56,982,582	74,880.658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566
IV	125,464,644	69,513,846	53,252,326
V	126,737,836	72,702,277	69,485,945
VI	122,315,240	66,146,229	61,449,650
VII	137,161,129	71,094,381	60,121,331

	VISIBLE STOCKS		
	United States	Europe	Total
VIII, 1911	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,380
IV	62,367,557	136,819,200	199,186,754
V	65,066,029	134,176,000	199,242,689
VI	49,615,643	117,801,600	107,417,232
VII	44,335,004	108,186,000	152,521,047
VIII	50,280,421	113,299,200	163,579,621

Curb trading has picked up with Davis Daly a strong feature. Nevada-Douglas is also strong. Alaska Mines stock, when issued, is quoted around $7.25@7.50, with $5 paid. It is expected that allotments will be cut down materially as the subscription demand has been heavy.

Assessments

Company	Delinq	Sale	Amt
Belcher, Nev	Aug. 15	Aug. 30	$0.10
Belmont, Ida	July 22	Aug. 22	0.002
Black Pine M. & M., Utah	Aug. 29	Sept. 19	0.00½
Cedar Talisman, Utah	Sept. 14	Oct. 3	0.00½
Con. Imperial, Nev	July 28	Aug. 21	0.01
Con. Virginia, Nev	Aug. 11	Sept. 5	0.20
Dalmatia, Ida	Aug. 24	Sept. 21	0.002
Dennemora, Ida	July 20	Aug. 20	0.002
Eagle Mt., Ida	July 31	Aug. 22	0.00½
Empire, Ida	Sept. 23	Oct. 23	0.002
Hilarity, Ida	Sept. 5	Oct. 5	0.002
Horseshoe Ida	Aug. 8	Aug. 30	0.002
JohnnyGold M.&M.Co.,Utah	Aug. 30	Sept. 20	0.00⅝
Laclede, Ida	Aug. 1	Aug. 24	0.003
Lone Star, Nev	July 20	.....	0.02
Manhattan Red Top, Nev	July 12	.....	0.01½
Mineral Hill, Nev	Aug. 5	Oct. 5	0.01
New Hope, Ida	Sept. 3	Oct. 3	0.002
New Reliance, S. Dak	.....	.....	0.01
Oreano, Ida	July 18	Aug. 19	0.001
Reindeer, Ida	Sept. 7	Oct. 5	0.003
Sandstorm-Kendall, Nev	July 8	.....	0.C1
Seven Troughs Mon'h, Utah	Aug. 10	Aug. 30	0.0½
Silver Mt., Ida	July 15	Aug. 15	0.002
Smuggler, Utah	Aug. 20	Sept. 20	0.00½
Springfield, Ida	July 30	Aug. 31	0.002
Tonopah North Star, Nev	July 15	.....	0.02
Twin Star, Ida	Aug. 31	Sept. 28	0.02

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24.483	24.595	27.284
May	53.870	53.308	60.880	24.797	24.583	28.038
June	53.462	53.043	61.290	24.651	24.486	28.215
July	54.150	52.630	60.654	25.034	24.286	27.919
August	52.912	52.171	.....	24.428	24.082	.....
September	53.295	52.440	.....	24.567	24.209	.....
October	55.490	53.340	.....	25.596	24.594	.....
November	55.635	55.719	.....	25.680	25.649	.....
December	54.428	54.905	.....	25.160	25.349	.....
Year	53.486	53.304	.....	24.670	24.592	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62.893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	15.741	12.275	15.930	54.034	70.294
May	11.989	16.031	12.214	16.245	54.313	72.352
June	12.385	17.234	12.611	17.443	56.365	78.259
July	12.463	17.190	12.720	17.353	56.673	76.636
August	12.405	.....	12.634	.....	56.266	.....
September	12.201	.....	12.508	.....	55.253	.....
October	12.189	.....	12.370	.....	55.170	.....
November	12.616	.....	12.769	.....	57.253	.....
December	13.552	.....	13.768	.....	62.068	.....
Year	12.376	.....	12.634	.....	55.973	.....

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42.529	July	42.400	44.519
February	41.614	42.962	August	43.319	.....
March	40.157	42.577	September	39.755	.....
April	42.185	43.923	October	41.185	.....
May	43.115	46.053	November	43.125	.....
June	44.606	45.815	December	44.655	.....
			Av. Year	42.281	.....

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412	4.200	4.262	4.118	12.889	16.331
May	4.373	4.194	4.223	4.072	12.984	16.509
June	4.435	4.392	4.292	4.321	13.260	17.588
July	4.499	4.720	4.397	4.603	13.530	18.544
August	4.500	.....	4.406	.....	14.260	.....
September	4.485	.....	4.356	.....	14.744	.....
October	4.265	.....	4.139	.....	15.332	.....
November	4.298	.....	4.181	.....	15.821	.....
December	4.450	.....	4.332	.....	15.648	.....
Year	4.420	.....	4.286	.....	13.970	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399	6.633	5.249	6.483	23.743	25.644
May	5.348	6.679	5.198	6.529	24.375	25.790
June	5.520	6.877	5.370	6.727	24.612	25.763
July	5.695	7.116	5.545	6.966	25.006	26.174
August	5.953	.....	5.803	.....	26.801	.....
September	5.869	.....	5.719	.....	27.750	.....
October	6.102	.....	5.951	.....	27.256	.....
November	6.380	.....	6.223	.....	26.795	.....
December	6.301	.....	6.151	.....	26.849	.....
Year	5.758	.....	5.608	.....	25.281	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90	15.13	14.65	13.90	15.00	14.15
May	15.90	15.14	14.30	13.90	14.72	14.12
June	15.90	15.15	14.06	14.11	14.56	14.22
July	15.90	15.15	14.03	14.38	14.53	14.38
August	15.90	.....	14.00	.....	14.47	.....
September	15.90	.....	13.57	.....	14.40	.....
October	15.43	.....	13.44	.....	14.34	.....
November	14.92	.....	13.30	.....	14.25	.....
December	15.15	.....	13.10	.....	13.90	.....
Year	$15.72	.....	$13.94	.....	$14.49	.....

STOCK QUOTATIONS

COLO. SPRINGS Aug. 27

Name of Comp.	Bid.
Acacia	.05
Cripple Cr'k Con.	.01⅞
C. K. & N.	.16
Doctor Jack Pot	.06½
Elkton Con.	.67
El Paso	1.15½
Findlay	.07½
Gold Dollar	.18½
Gold Sovereign	.02
Isabella	.21½
Jack Pot	.04
Jennie Sample	.06⅜
Lexington	.008
Moon Anchor	.009
Old Gold	.04
Mary McKinney	.70½
Pharmacist	.01½
Portland	.99½
Vindicator	.85
Work	.01½

SALT LAKE Aug. 27

Name of Comp.	Bid.
Beck Tunnel	.09
Black Jack	.12
Cedar Talisman	.00⅜
Colorado Mining	.19½
Columbus Con.	.20
Crown Point	.02¼
Daly-Judge	5.75
Grand Central	.57
Iron Blossom	1.25
Little Bell	.30
Lower Mammoth	.04½
Mason Valley	12.00
May Day	.16
Nevada Hills	2.00
New York	.03
Prince Con	1.65
Silver King Coal'n	2.75
Sioux Con.	.05
Uncle Sam	.17
Yankee	.11

TORONTO Aug. 27

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	7.45	Hollinger	12.50
Hudson Bay	69.00	Imperial	.02
Temiskaming	.37	Pearl Lake	.16
Wettlaufer-Lor	.44	Porcu. Gold.	.26
Apex	.02	Porcu. Tisdale	.01
Central	‡5.56	Preston E. D.	.02
Crown Chartered	.07	Rea	.20
Dobie	.40	Standard	.00½
Dome Exten.	.09	Swastika	.08
Foley O'Brien	.15	West Dome	.05

SAN FRANCISCO Aug. 27

Name of Comp.	Clg.
COMSTOCK STOCKS	
Alta	.09
Belcher	.40
Best & Belcher	.08
Caledonia	1.60
Challenge Con.	.09
Chollar	.10
Confidence	.75
Con. Virginia	.53
Crown Point	.45
Gould & Curry	.03
Hale & Norcross	.12
Mexican	2.90
Occidental	.50
Ophir	.91
Overman	.81
Potosi	.03
Savage	.07
Sierra Nevada	.16
Union Con.	.73
Yellow Jacket	.41

Name of Comp.	Bid
MISC. NEV. & CAL.	
Belmont	9.85
Jim Butler	.68
MacNamara	.24
Midway	.58
Mont.-Tonopah	2.22½
North Star	.16
West End Con.	1.67½
Atlanta	.26
Booth	.07
C.O.D. Con.	.11
Comb. Frac.	.05
Jumbo Extension	.42
Pitts.-Silver Peak	.90
Silver Pick	.11
St. Ives	.30
Tramp Con.	‡.02
Argonaut	‡2.00
Bunker Hill	‡4.50
Central Eureka	.34
So. Eureka	‡2.90

N. Y. EXCH. Aug. 27

Name of Comp.	Clg.
Amalgamated	88½
Am. Agri. Chem.	59½
Am.Sm.&Ref.,com	87¾
Am. Sm. & Ref., pf.	109¼
Am. Sm. Sec., pf. B	87¾
Anaconda	46½
Batopilas Min.	1⅜
BethlehemSteelpf	73¾
Chino	39⅝
Comstock Tunnel	‡.10½
Federal M. & S., pf.	45
Goldfield Con.	3¾
GreatNor.,ore,ctf.	45⅛
Guggen. Exp.	59⅞
Homestake	95½
Inspiration Con.	19
Miami Copper	29½
Nat'nalLead,com.	60½
National Lead, pf.	107½
Nev. Consol.	22⅞
Pittsburg Coal, pf.	98⅜
Ray Con.	21⅜
Republic I&S,com.	28½
Republic I & S, pf.	91¼
SlossSheffi'd,com.	56
Sloss Sheffield, pf.	100
Tennessee Copper	43¾
Utah Copper	66¾
U. S. Steel, com	74¾
U. S. Steel, pf.	113½
Va. Car. Chem.	47¾

N. Y. CURB Aug. 27

Name of Comp.	Clg.
Barnes King	‡.40
Beaver Con	.46
Braden Copper	7⅛
B. C. Copper	5⅛
Buffalo Mines	‡1.45
Caledonia	.40
Con. Ariz. Sm.	⅝
Davis-Daly	2¾
Diam'field-Daisy	7
Ely Con.	.22
Florence	1 1/32
Giroux	6
Gold Hill Con.	1/16
Greene Cananea	10⅜
Greenwater	.05
Internat. S. & R.	‡124
Kerr Lake	2 13/16
Keystone	2⅜
La Rose	3
McKinley-Dar-Sa.	2
Min. Co. of A. new	3
Motherlode Gold.	1
Nev. Utah M. & S.	01
Nipissing Mines	8¾
Ohio Copper	1⅛
Pacific Sm. & M.	⅛
South Live Oak	1¾
South Utah M. & S.	5/16
Standard Oil (Old)	1110
Stand'd Oil of N.J.	409
Stand'd Oil Subs.	525
Stewart	1 5/16
Tonopah	7 1/16
Tonopah Ex.	2¾
Tri-Bullion	⅛
Tularosa	1
Union Mines	‡⅛
United Cop., pfd.	10
Yukon Gold	3⅛

LONDON Aug. 28

Name of Com.	Clg.
Camp Bird	£1 9s 3d
Dolores	1 10 0
El Oro	0 14 3
Esperanza	1 11 10½
Mexico Mines	7 5 0
Oroville	0 5 3
Stratton'sInd.	0 3 1½
Tomboy	1 6 3

BOSTON EXCH. Aug. 27

Name of Comp.	Clg.
Adventure	8½
Ahmeek	‡345
Algomah	5½
Allouez	46¾
Am. Zinc	31¾
Ariz. Com., ctfs.	5¼
Bonanza	‡.40
Boston & Corbin	7⅜
Butte & Balak	‡3⅛
Calumet & Ariz.	82¾
Calumet & Hecla	555
Centennial	22⅞
Con. Mercur	‡.03
Copper Range	60¾
Daly West	‡5
East Butte	14
Franklin	11½
Granby	57
Hancock	28½
Hedley Gold	19⅞
Helvetia	1
Indiana	18½
Island Cr'k, com.	55
Island Cr'k, pfd.	‡91
Isle Royale	36¼
Keweenaw	1¾
Lake	36
La Salle	6½
Mass	7
Michigan	‡2½
Mohawk	‡60⅞
New Arcadian	‡4½
New Idria Quick	‡6⅞
North Butte	34½
North Lake	5¾
Ojibway	‡4
Old Dominion	60¾
Osceola	‡118
Quincy	92½
Shannon	16¾
Shattuck-Ariz.	20½
Superior	47⅛
Superior & Bost.	1⅞
Tamarack	43
Trinity	‡6¼
Tuolumne	2⅛
U. S. Smelting	45¾
U. S. Smelt'g, pf.	50
Utah Apex	2¼
Utah Con.	12
Victoria	‡3
Winona	‡5¼
Wolverine	107
Wyandot	2

BOSTON CURB Aug. 27

Name of Comp.	Last
Bingham Mines	3 3/16
Boston Ely	1 1/16
Boswyocolo	.02
Butte Central	7 5/16
Cactus	.11
Calaveras	27/32
Chief Cons	1 13/16
Corbin	.90
Cortez	1
Crown Reserve	3½
First Nat. Cop.	2 1/16
Majestic	1/32
Mazatan	1½
Moneta Porc.	‡.05
Nevada-Douglas	3⅜
New Baltic	2½
Oneco	1½
Raven Copper	.29
Rhode Island Coal	18
San Antonio	‡3
S. W. Miami	6
South Lake	9½
Trethewey	.40
United Verde Ext.	.37
Vulture	‡5

‡Last quotation.